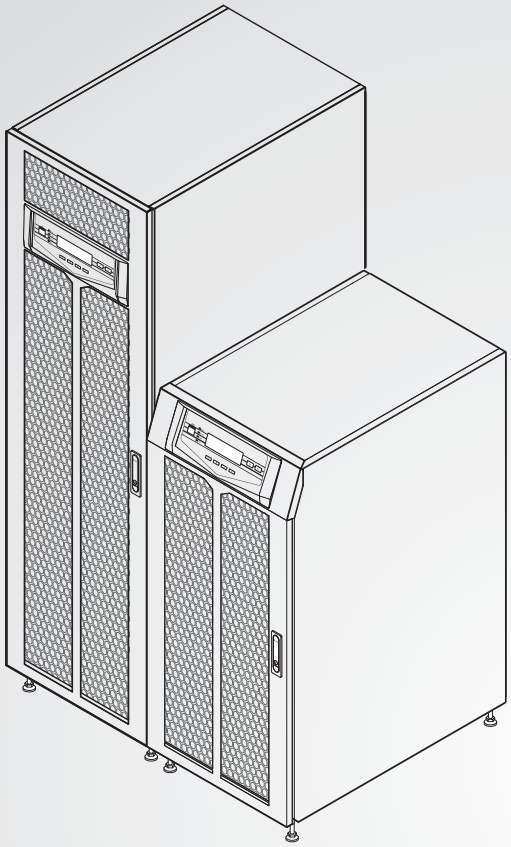


The power behind competitiveness

Delta UPS - Ultron Family

HPH Series, Three Phase
60/80/100/120 kVA

User Manual

www.deltapowersolutions.com

Smarter. Greener. Together.

Save This Manual

This manual contains important instructions and warnings that you should follow during the installation, operation, storage and maintenance of this product. Failure to heed these instructions and warnings will void the warranty.

Copyright © 2015 by Delta Electronics Inc. All Rights Reserved. All rights of this User Manual ("Manual"), including but not limited to the contents, information, and figures are solely owned and reserved by Delta Electronics Inc. ("Delta"). The Manual can only be applied to the operation or the use of this product. Any disposition, duplication, dissemination, reproduction, modification, translation, extraction, or usage of this Manual in whole or in part is prohibited without the prior written permission of Delta. Given that Delta will continuously improve and develop the product, changes may be made to the information in this Manual at any time without obligation to notify any person of such revision or changes. Delta will make all possible efforts to secure the accuracy and the integrity of this Manual. Delta disclaims any kinds or forms of warranty, guarantee, or undertaking, either expressly or implicitly, including but not limited to the completeness, faultlessness, accuracy, non-infringement, merchantability or fitness for a particular purpose of the Manual.

Table of Contents

Chapter 1 : Important Safety Instructions ----------1

1.1 Placement Warnings---------- 1
1.2 Connection Warnings---------- 1
1.3 Usage Warnings ---------- 1
1.4 Storage Warnings ---------- 2
1.5 Glossary of Symbols---------- 3
1.6 Standard Compliance ---------- 4

Chapter 2 : Introduction ----------5

2.1 Product Introduction ---------- 5
2.2 Package Inspection ---------- 5
2.3 Functions and Features---------- 7

Chapter 3 : Appearance and Mechanism----------9

3.1 Appearance and Dimensions---------- 9
3.2 Control Panel ----------10
3.3 Front/ Rear Panel ----------12

Chapter 4 : Operation Modes ---------- 17

Chapter 5 : Communication Interfaces ---------- 21

Chapter 6 : Installation and Wiring---------- 27

6.1 Precautions Prior to Installation and Wiring ----------27
6.2 Installation Environment ----------27
6.3 UPS Transportation & Handling ----------28
6.4 UPS Installation & Fixing ----------28
6.5 Wiring----------31
6.5.1 Precautions Prior to Wiring ----------31
6.5.2 Single Unit Wiring ----------34
6.5.3 Parallel Units Wiring ----------41
6.6 External Battery Cabinet Connection Precautions ----------44

Chapter 7 : UPS Operation---------- 49

7.1 Single Unit Operation Procedures ----------49
7.1.1 Normal Mode Start-up Procedures (Single) ----------49

7.1.2 Battery Mode Start-up Procedures (Single) ----------49
7.1.3 Bypass Mode Start-up Procedures (Single)----------50
7.1.4 Manual Bypass Mode Start-up Procedures (Single Unit) ----50
7.1.5 Normal Mode Turn-off Procedures (Single) ----------51
7.1.6 Battery Mode Turn-off Procedures (Single)----------51
7.1.7 Bypass Mode Turn-off Procedures (Single) ----------52
7.1.8 Manual Bypass Mode Turn-off Procedures (Single)----------52
7.2 Parallel Units Operation Procedures ----------53
7.2.1 Normal Mode Start-up Procedures (Parallel) ----------53
7.2.2 Battery Mode Start-up Procedures (Parallel)----------53
7.2.3 Bypass Mode Start-up Procedures (Parallel) ----------53
7.2.4 Manual Bypass Mode Start-up Procedures (Parallel)---------54
7.2.5 Normal Mode Turn-off Procedures (Parallel)----------55
7.2.6 Battery Mode Turn-off Procedures (Parallel)----------55
7.2.7 Bypass Mode Turn-off Procedures (Parallel)----------56
7.2.8 Manual Bypass Mode Turn-off Procedures (Parallel)---------56

Chapter 8 : LCD Display and Settings ---------- 57

8.1 LCD Display Hierarchy----------57
8.2 Main Screen ----------58
8.3 Parallel Screen----------59
8.4 Main Menu ----------60
8.5 Measure ----------61
8.6 Maintenance----------62

Chapter 9 : Optional Accessories ---------- 65

Chapter 10 : Maintenance ---------- 66

Chapter 11 : Troubleshooting ---------- 67

Appendix 1 : Technical Specifications ---------- 69

Appendix 2 : Warranty ---------- 71

Chapter 1 : Important Safety Instructions

1.1 Placement Warnings

- Install the UPS in a well-ventilated indoor area, away from excess moisture, heat, dust, flammable gas or explosives.
- Leave adequate space around all sides of the UPS for proper ventilation. Please refer to ***6.2 Installation Environment***.

1.2 Connection Warnings

- The UPS must be well grounded due to a possible risk of current leakage.
- It is necessary to install protective devices when the UPS is connected to the mains and bypass source. For relevant information, please refer to ***6.5.1 Precautions Prior to Wiring***.
- The protective devices connecting to the UPS must be installed near the UPS and must be easily accessible for operation.

1.3 Usage Warnings

- This is a class-A product. In a domestic environment, this product may cause radio interference, in which case, the user is required to take adequate measures.
- The UPS can be used to power computers and associated peripheral devices, such as monitors, modems, cartridge tape drives, external hard drives, etc.
- If the UPS needs to be connected to a motor load, it must be confirmed by qualified service personnel.
- It is strictly forbidden to connect the UPS with any regenerative-type loads.
- The parallel UPSs can connect with common batteries.
- The external slits and openings in the UPS are provided for ventilation. To ensure reliable operation of the UPS and to protect the UPS from overheating, these slits and openings must not be blocked or covered. Do not insert any object into the slits and openings that may hinder ventilation.
- In a low temperature environment (below 0°C), you must allow the UPS to adjust to room temperature for at least one hour to avoid moisture condensing inside the UPS before usage.

- Do not put beverage containers on the UPS, battery cabinet or any other accessory associated with the UPS.
- The risk of dangerous high voltage is possible when the batteries are still connected to the UPS even though the UPS is disconnected from the mains. Do not forget to pull out the battery cable to completely cut off the battery source.
- Do not open or mutilate the battery or batteries. The released electrolyte is harmful to the skin and eyes and may be toxic.
- Do not dispose of the battery or batteries in a fire. The batteries may explode.
- All maintenance services must be performed by qualified service personnel. Forbid opening or removing the cover of the UPS to avoid high voltage electric shock.
- You must contact qualified service personnel if either of the following events occur:

  1. Liquid is poured or splashed on the UPS.
  2. The UPS does not run normally after this User Manual is carefully observed.

NOTE:
If you use the UPS in an area that generates or incurs dust, you should install a dust filter in the UPS to ensure normal product life and function.

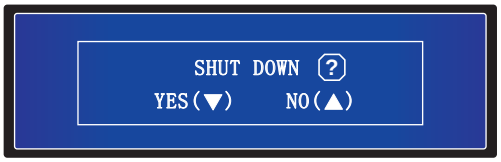
1.4 Storage Warnings

- **Prior to Installation**

  If the UPS needs to be stored prior to installation, it should be placed in a dry area. The allowable storage temperature is between -15°C and +50°C.

- **After Usage**

  Press the **OFF** key (OFF) once and the LCD shows the following screen. If you want to turn off the UPS, please press the **DOWN** key (▼). Make sure the UPS is shutdown, disconnect the UPS from the utility power, remove all equipment from the UPS, and store the UPS in a dry and well-ventilated area at a temperature between -15°C and +50°C. Idle batteries must be re-charged fully approximately every three months if the UPS needs to be stored for an extended period of time. The charging time must not be less than 24 hours each time.



1.5 Glossary of Symbols

No.	Symbol	Description
1	NORMAL	Online mode LED indicator: green
2	BATTERY	Battery mode LED indicator: yellow
3	BYPASS	Bypass mode LED indicator: yellow
4	FAULT	Fault LED indicator: red
5	ON	ON key
6	OFF	OFF key
7	ESC	Goes back to previous screen or cancels current selection.
8	▼	Moves down/ Decreases number.
9	▲	Moves up/ Increases number.
10	↵	Confirms selection.
11	EPO	EPO key
12	R	R phase of AC Input/ Bypass Input/ UPS Output
13	S	S phase of AC Input/ Bypass Input/ UPS Output
14	T	T phase of AC Input/ Bypass Input/ UPS Output
15	N	Neutral line of AC Input/ Bypass Input/ UPS Output/ Battery Input
16	⏚	For UPS grounding
17	⏚	For critical loads' grounding/ For external battery cabinet's grounding
18	+	Positive battery terminal
19	−	Negative battery terminal

1.6 Standard Compliance

This product meets the following safety standards and electromagnetic compatibility (EMC) in-spection standards:

- CE
- IEC62040-1
- GB7260.2-2009/ IEC62040-2 C3
- GB17626-2/ IEC61000-4-2 (ESD) Level 4
- GB17626-3/ IEC61000-4-3 (Radiated Field) Level 3
- GB17626-4/ IEC61000-4-4 (EFT) Level 4
- GB17626-5/ IEC61000-4-5 (Surge) Level 4

Chapter 2 : Introduction

2.1 Product Introduction

The HPH series UPS is a three-phase four-wire online uninterruptible power supply which provides reliable and stable sine-wave power to your electronic devices. The UPS applies the latest design of DSP digital control technology and highest quality assembly, with an output power factor up to unity. The efficiency of the entire device can reach up to 96% in online mode and up to 99% in ECO mode. With its outstanding features, the UPS not only provides safe, reliable and uninter-rupted power to your sensitive electronic equipment at all times, but also produces greater electric power efficiency at less cost. This HPH series UPS provides four different rated power levels, 60kVA, 80kVA, 100kVA and 120kVA, for your selection.

2.2 Package Inspection

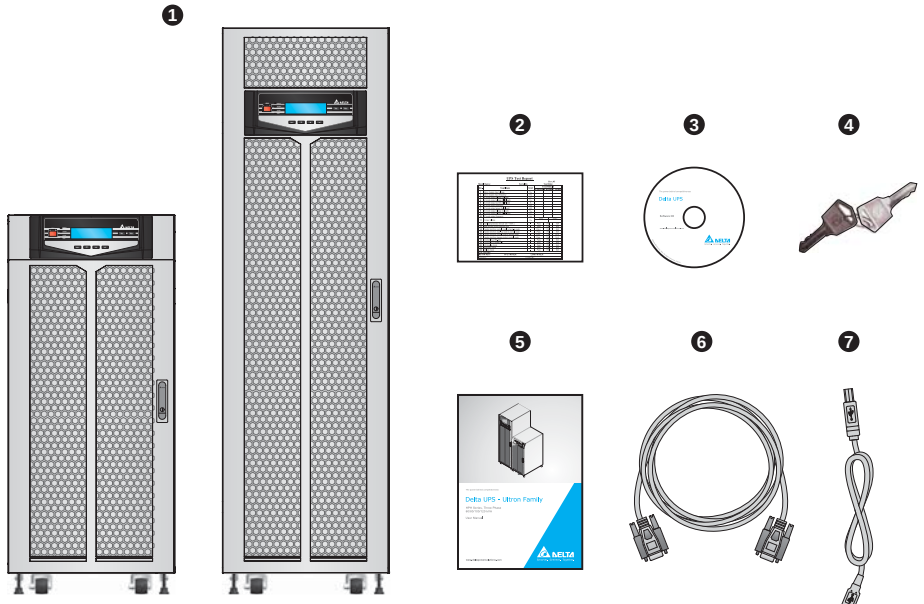
- **External**

  During UPS transportation, some unpredictable situations might occur. It is recommended that you inspect the UPS exterior packaging. If you notice any damage, please immediately contact the dealer from whom you purchased the unit.

- **Internal**

  1. Check the rating label on the top of the UPS cabinet and make sure the device No. and capacity match what you ordered.
  2. Examine if any parts are loose or damaged.

3. The UPS package contains the following items. Please check if any items are missing.



(60/ 80kVA) (100/ 120kVA)

No.	Item	Q'ty
❶	UPS	1 PC
❷	Test Card	1 PC
❸	Software CD-UPSentry 2012	1 PC
❹	Key	1 Set (two copies placed inside the UPS cabinet)
❺	User Manual	1 PC
❻	Parallel Cable	1 PC
❼	USB Cable	1 PC

NOTE:

The balance supports have been locked on the pallet when the UPS is shipped out of the factory. Please keep them well after unpacking. You might use them for installation.

4. If there is any damage or anything missing, please immediately contact the dealer from whom you purchased the unit.
5. If the UPS needs to be returned, carefully repack the UPS and all of the accessories using the original packing material that came with the unit.

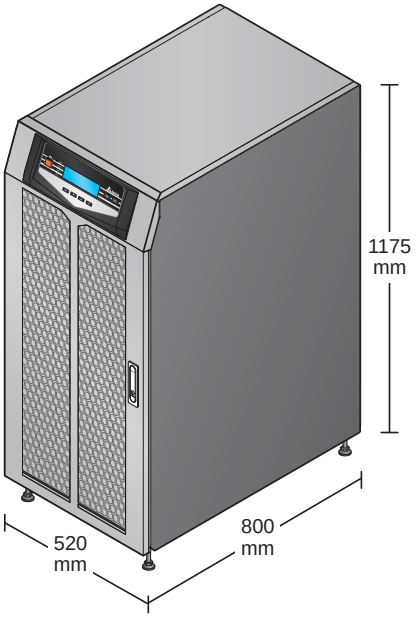
2.3 Functions and Features

- The HPH series UPS is designed for systems with medium power. It provides clean power supply to data systems, communication systems, computer network systems, medical treatment systems, monitoring systems, factory equipment, etc.
- The HPH series UPS utilizes all digital high frequency modulation technology, which decreases volume, improves reliability and prolongs service life.
- Wide AC input voltage range (full load: 173~276/ 300~477Vac; 70% load: 132~173/ 228~300Vac) reduces frequent transfer from normal mode to battery mode to save battery consumption and prolong battery life.
- Battery test in online mode and regular battery test prolong battery life.
- Automatic input frequency detection enables operation at 50Hz or 60Hz.
- You can parallel at maximum four UPS units for N+X parallel redundancy, capacity expansion and reliability enhancement.
- It is convenient to set the parameters (output voltage, charging current, output frequency and password setting, etc.) on the LCD panel.
- The operating conditions, such as load, input and output voltage, input and output frequency, battery voltage, of the device are available on LCD so that management personnel can see them accurately and clearly.
- It can set the output voltage on LCD as: 220/ 230/ 240Vac.
- The CPU can record up to 1000 entries of abnormal information of the UPS, which is helpful in fault diagnosis for the UPS and in the improvement of the maintenance efficiency.
- No-battery start-up: In case the external battery cabinet is not connected, the device can still start up normally with normal AC.
- REPO port: Under emergency status, use a user-supplied remote control switch to disconnect the output immediately to prevent any danger.
- Built-in RS-232 port allows monitoring and management of the UPS via the UPSentry 2012 software (http://www.deltapowersolutions.com/en/mcis/software-center.php).
- Attaches optional accessories like SNMP and Mini SNMP cards for network communication.
- Other optional accessories include Mini Relay I/O, Mini USB, Mini ModBus and Mini TVSS cards for dry contact, USB communication, ModBus communication and surge protection.
- In order to improve the efficiency further, the UPS can be set to operate in ECO mode. In case of any abnormal conditions, the UPS will transfer to online mode automatically.

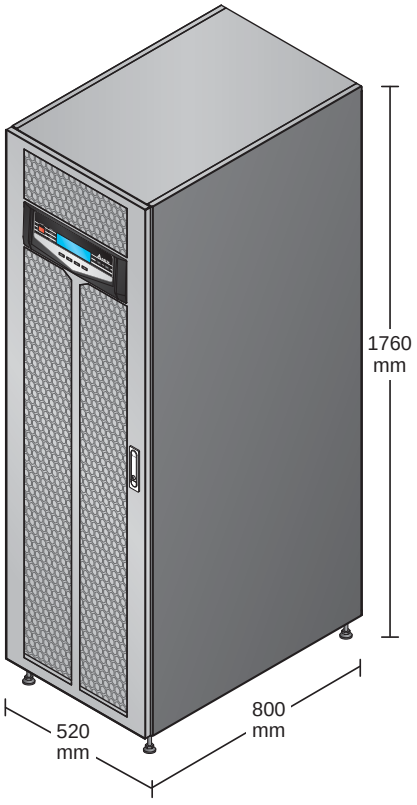
- Automatically detects and shows whether fans are operating normally.
- The fans have automatic speed regulation function. With multi-stage control over the fan speed, it can improve the reliability and the efficiency of the system, reduce the noise and prolong the service life of the fans.
- Provides boost charge and float charge. You can adjust the charge current from 2A to the maximum (please refer to ***6.6 External Battery Cabinet Connection Precautions***). Each adjustment level is 0.5A. The charging mode is set according to the actual charging current so as to keep the batteries at full charging capacity and prolong the battery life (float charge voltage: 272Vdc; boost charge voltage: 280Vdc).

Chapter 3 : Appearance and Mechanism

3.1 Appearance and Dimensions

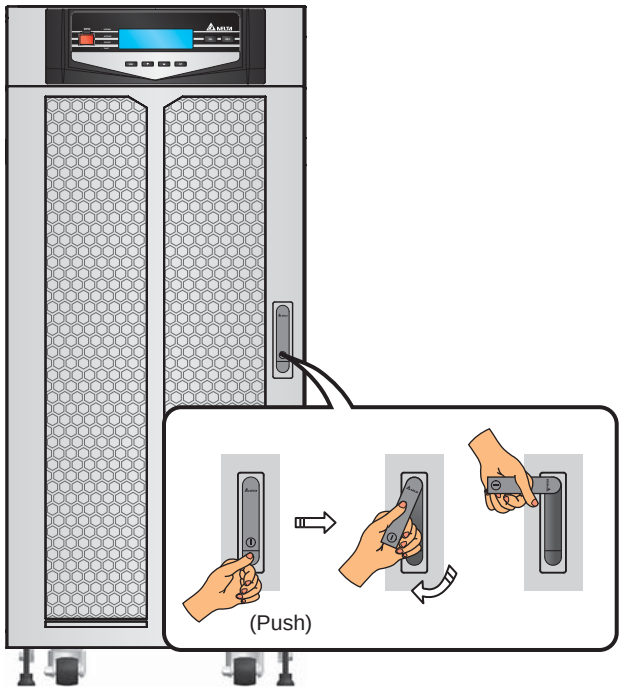


(Figure 3-1: 60/ 80kVA UPS Appearance and Dimensions)



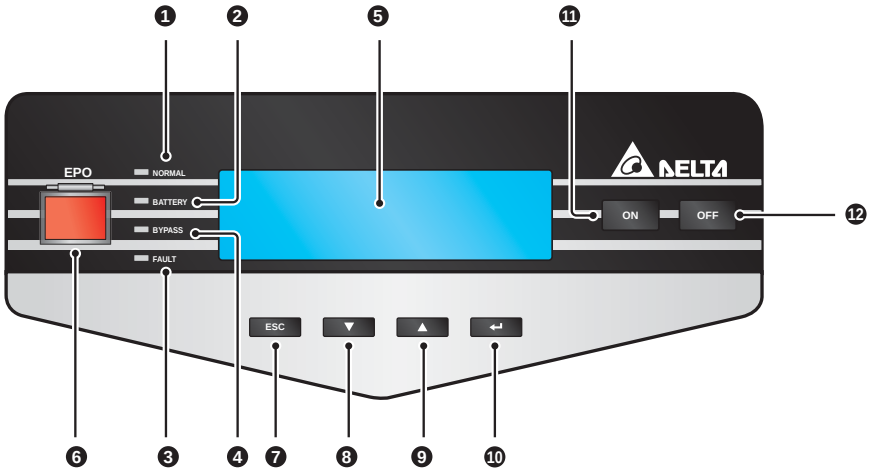
(Figure 3-2: 100/ 120kVA UPS Appearance and Dimensions)

On the front of the UPS, there is a control panel and a lockable door switch. Please refer to ***Figure 3-3*** for how to open the UPS's front door.

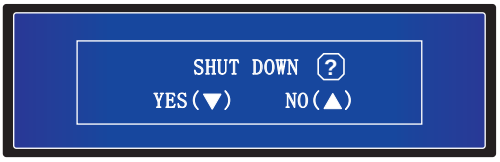


(Figure 3-3: Open the Front Door)

3.2 Control Panel



(Figure 3-4: Control Panel)

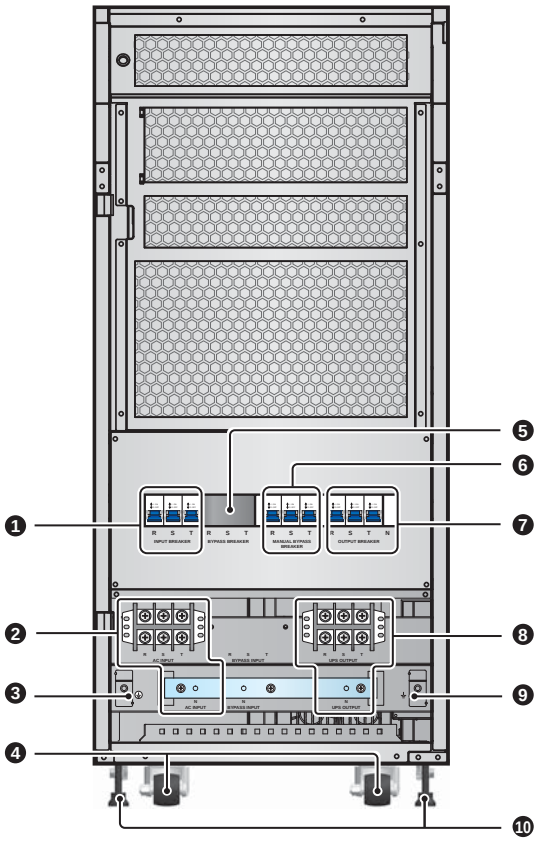
No.	Item	Description
❶	NORMAL	It indicates that the UPS is operating in online mode and the utility AC power is normal.
❷	BATTERY	It indicates that the UPS is operating in battery mode and the external batteries are discharging.
❸	FAULT	It indicates that the UPS has abnormalities.
❹	BYPASS	It indicates that the UPS is operating in bypass mode.
❺	LCD Display	It displays the operating status of the UPS and the relevant monitoring data.
❻	EPO	When an emergency event occurs, press the **EPO** key for over 1 second to shut down the rectifier, inverter and output of the UPS immediately.
❼	ESC	Goes back to previous screen or cancels current selection.
❽	▼	Moves down/ Decreases number.
❾	▲	Moves up/ Increases number.
❿	↵	Confirms selection.
⓫	ON	**ON** key: Press this key for 3~4 seconds and release it after you hear a beep to start up the UPS.
⓬	OFF	**OFF** key: Press this key once and the LCD shows the following screen. To turn off the UPS, please press the **DOWN** key (▼). 

3.3 Front/ Rear Panel

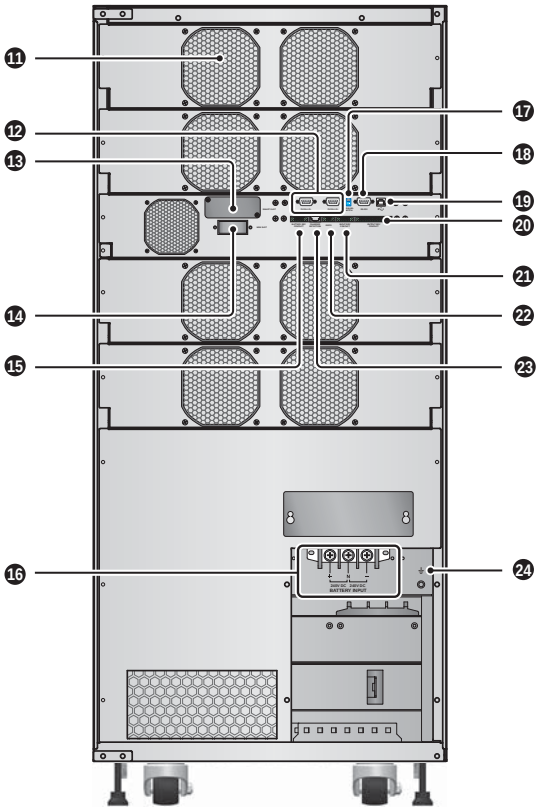
Open the UPS's front door, remove the front and real panels, and you will see the internal mechanisms.

- **60kVA Model**

(Front Panel)

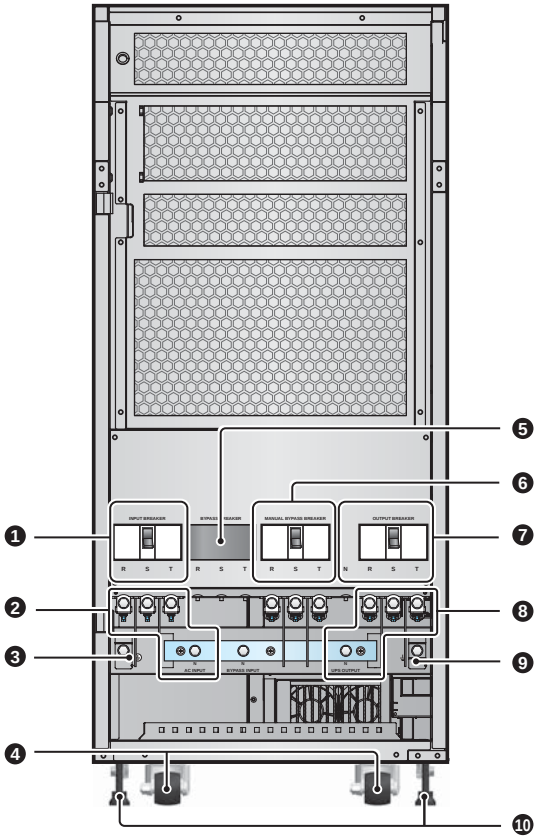


(Rear Panel)

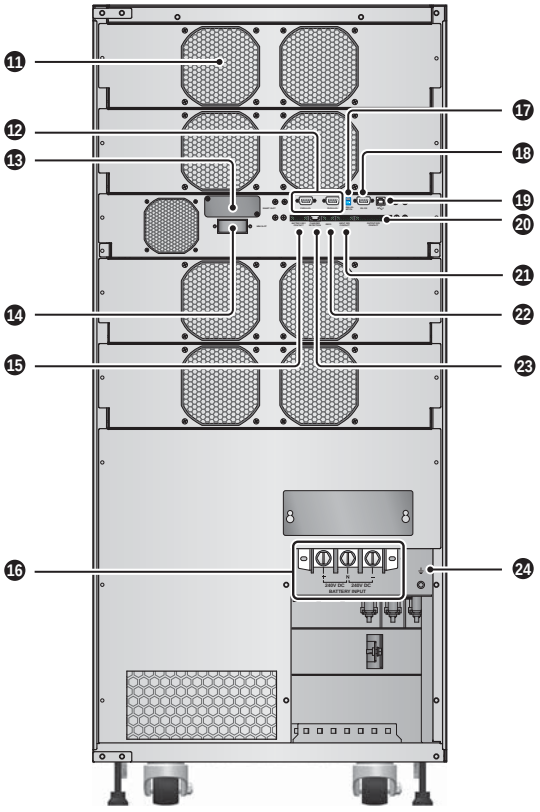


- **80kVA Model**

(Front Panel)

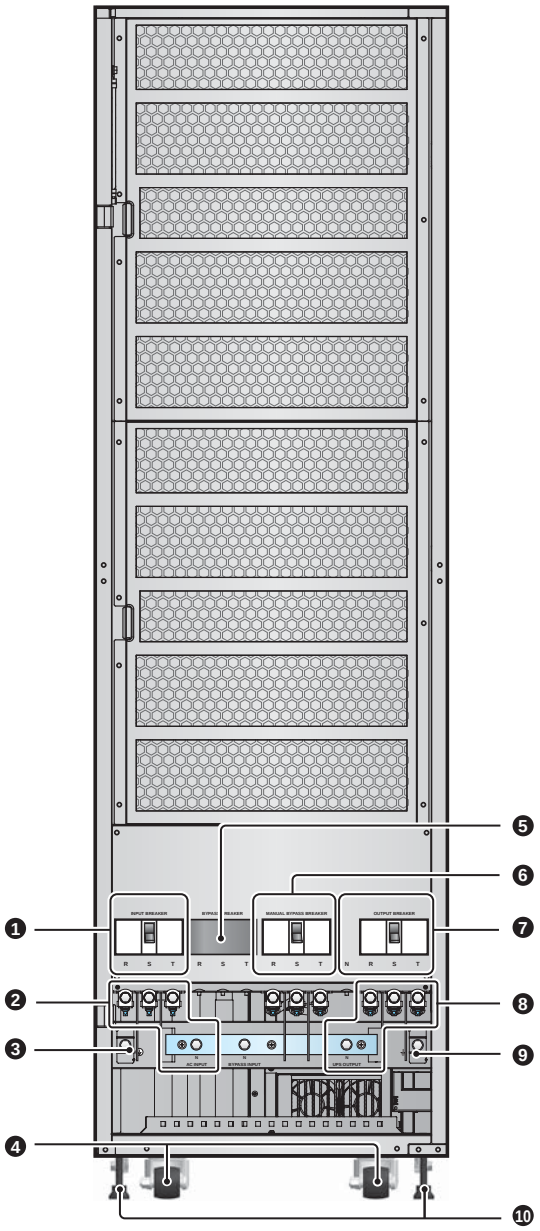


(Rear Panel)

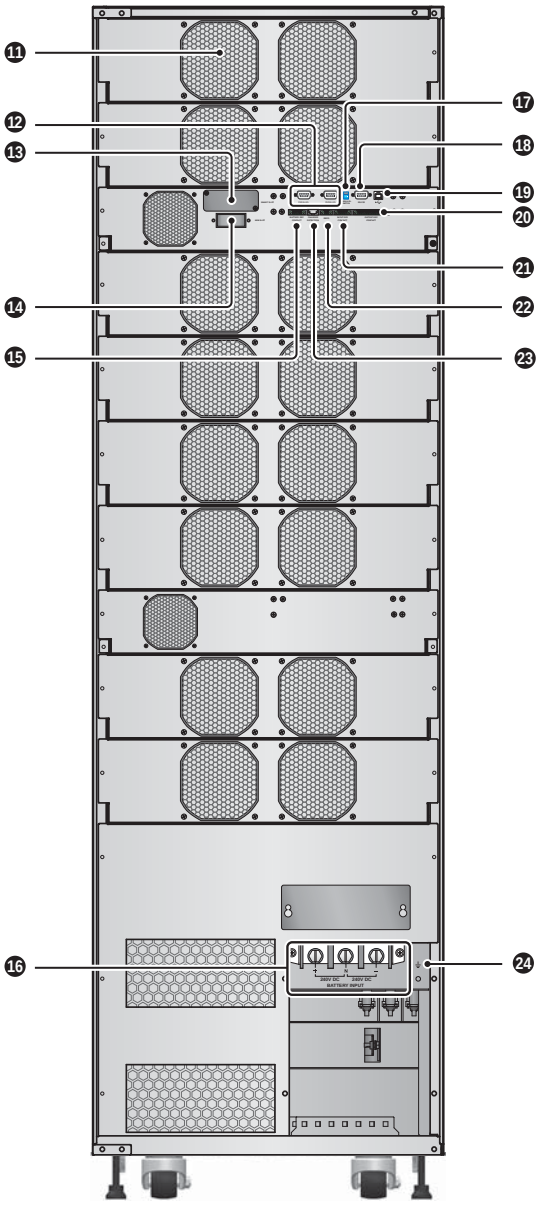


- **100/120kVA Model**

(Front Panel)



(Rear Panel)



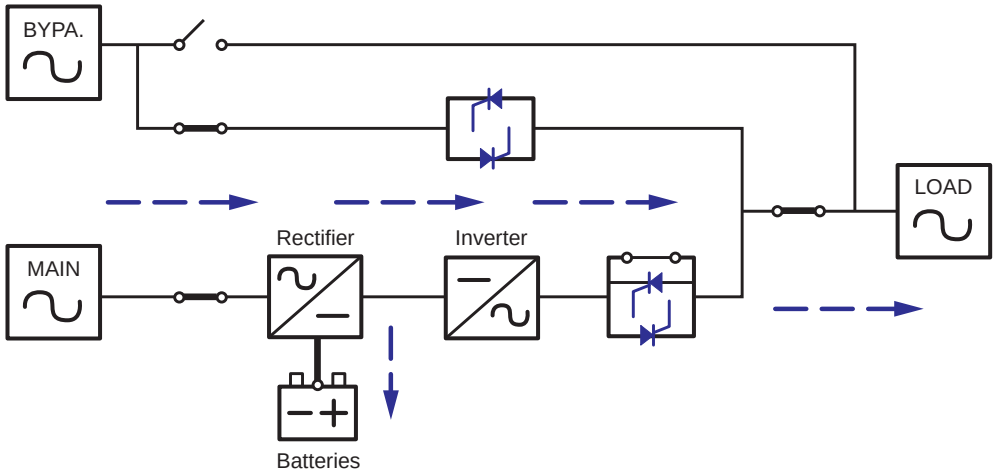
No.	Item	Description
❶	Input Breaker	Controls the UPS's input breaker and for safety protection.
❷	AC Input Terminal Block	Connects the main AC source.
❸	⏚	For the UPS grounding.
❹	Casters	The casters are designed for a short distance movement only. Do not use the casters to move the UPS over a long distance. The casters are not designed to provide long-term support for the UPS. Please refer to ***6.4 UPS Installation & Fixing*** for how to firmly fix the UPS on the ground.
❺	Bypass Breaker	Controls the UPS's bypass breaker. Follow customer's requirement to decide whether the bypass breaker should be installed or not.
❻	Manual Bypass Breaker	For maintenance only! Only authorized service personnel can operate the manual bypass breaker.
❼	Output Breaker	Controls the UPS's output breaker and for safety protection. The default is a 3-pole output breaker. An alternative of a 4-ploe one could be installed according to customer's requirement.
❽	UPS Output Terminal Block	Connects the critical loads.
❾	⏚	For the critical loads' grounding.
❿	Levelers	The levelers are designed to provide long-term support for the UPS.
⓫	DC Fans	Cool and ventilate the UPS.
⓬	Parallel Ports	For UPS parallel usage. For detailed information, please refer to ***Chapter 5: Communication Interfaces***.
⓭	SMART Slot	Connects SNMP/ Relay I/O/ ModBus card. For detailed information, please refer to ***Chapter 5: Communication Interfaces***.
⓮	MINI Slot	Connects Mini SNMP/ Mini Relay I/O/ Mini USB/ Mini Mod-Bus/ Mini TVSS card. For detailed information, please refer to ***Chapter 5: Communication Interfaces***.
⓯	Battery Dry Contact	Connects an external battery cabinet. For detailed information, please refer to ***Chapter 5: Communication Interfaces***.

No.	Item	Description
⑯	Battery Input Terminal Block	Connects an external battery cabinet.
⑰	Parallel Switch	Controls parallel ports' status (ON or OFF). For detailed information, please refer to ***Chapter 5: Communication Interfaces***.
⑱	RS-232 Port	Connects to a computer. For detailed information, please refer to ***Chapter 5: Communication Interfaces***.
⑲	USB Port	Connects to a computer. For detailed information, please refer to ***Chapter 5: Communication Interfaces***.
⑳	Output Dry Contacts	Receive the UPS's event information. Please refer to ***Chapter 5: Communication Interfaces***.
㉑	Input Dry Contacts	Receive external information of devices connected to the input dry contacts. Please refer to ***Chapter 5: Communication Interfaces***.
㉒	REPO Port	When an emergency event occurs, it can disconnect the UPS power supply rapidly and shut down the UPS safely and immediately. For detailed information, please refer to ***Chapter 5: Communication Interfaces***.
㉓	Charger Detection Port	Connects to a charger box and detects the charger status. Please refer to ***Chapter 5: Communication Interfaces***.
㉔	⏚	For the external battery cabinet's grounding.

Chapter 4 : Operation Modes

- **Online Mode**

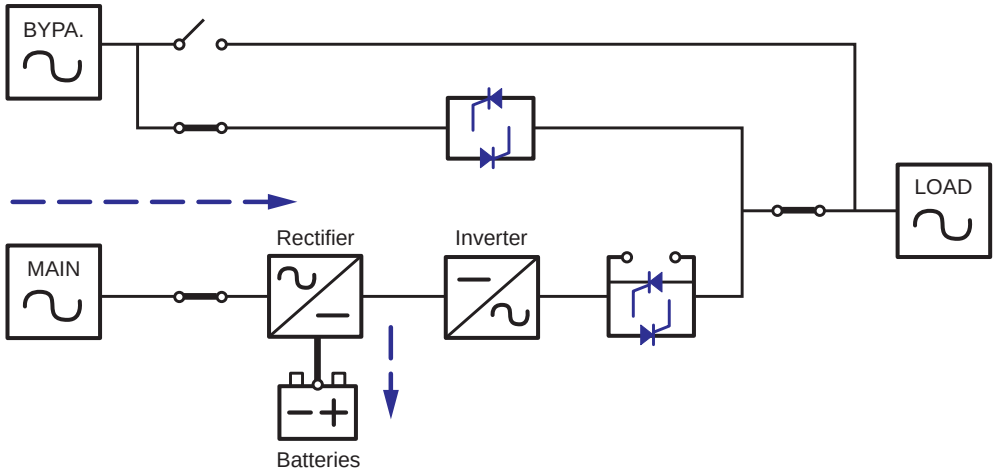
  The critical load is supplied by the inverter, which derives its power from the utility AC power, and the UPS charges the batteries as needed and provides power protection to the equipment. During on-line mode, the NORMAL LED indicator (NORMAL) illuminates (green).



(Figure 4-1: Path of Electrical Power through the UPS in Online Mode)

- **Standby Mode**

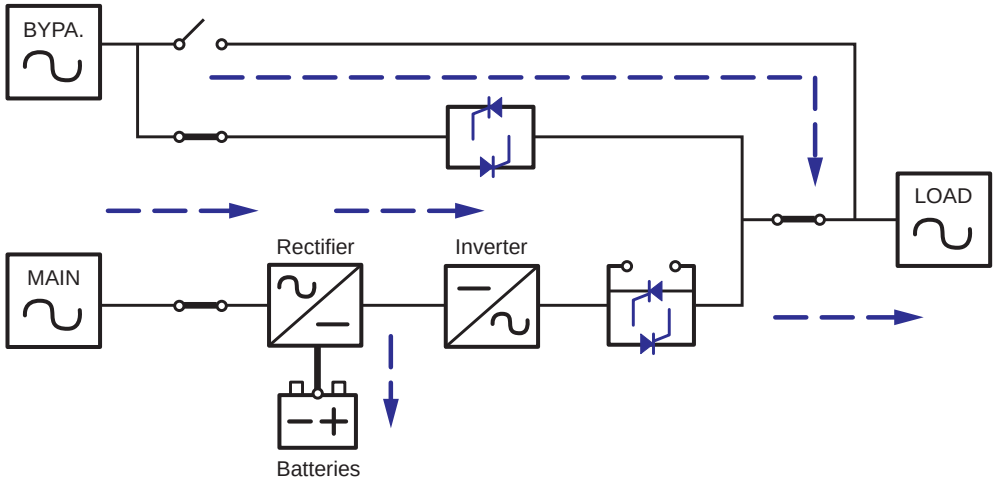
  When the utility AC power's input voltage and frequency are within the main input's normal range but out of the bypass input's normal range, the UPS runs in standby mode and charges the batteries. The bypass and the inverter have no output.



(Figure 4-2: Path of Electrical Power through the UPS in Standby Mode)

- **ECO Mode**

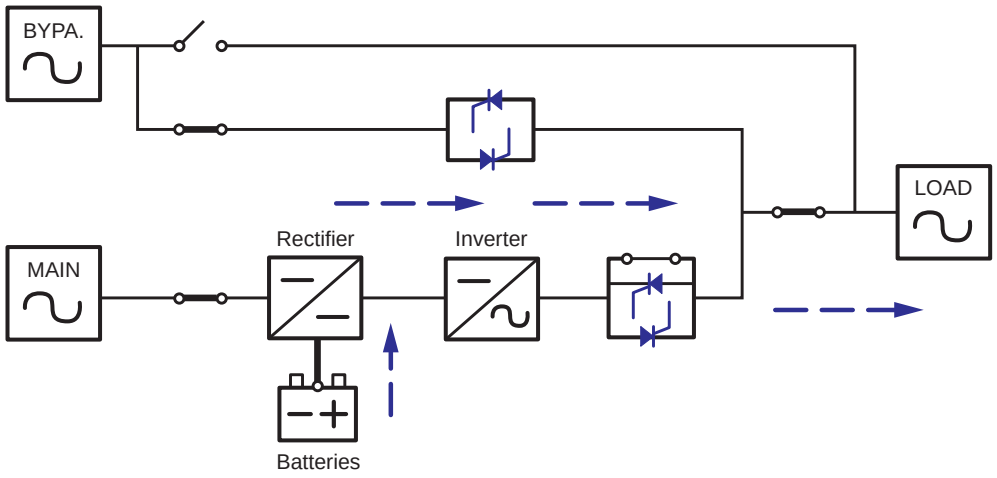
  You can manually set the UPS into ECO mode. In ECO mode, when the input voltage is within the range of rated voltage 5%~10%, the load is supplied by the bypass source and the BYPASS LED indicator (BYPASS) illuminates (yellow); if out of the range, the load is supplied by the inverter and the NORMAL LED indicator (NORMAL) illuminates (green).



(Figure 4-3: Path of Electrical Power through the UPS in ECO Mode)

- **Battery Mode**

  When the UPS is operating during a power outage, the batteries provide DC power, which maintains inverter operation to support the critical load. During battery mode, the BATTERY LED indicator (BATTERY) illuminates (yellow).



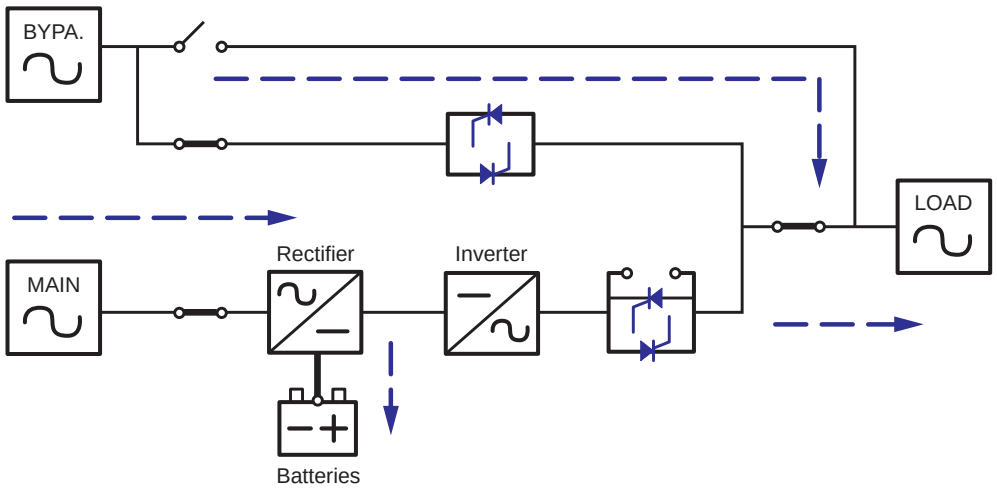
(Figure 4-4: Path of Electrical Power through the UPS in Battery Mode)

Table 4-1: The battery status is as follows

Battery Capacity	Buzzer	LCD Display
Full/ Mid	The alarm beeps once every 10 seconds. (ON for 0.1 second and OFF for 9.9 seconds)	BATTERY CAPACITY 00V/ 000%
Low	The alarm beeps once every 0.5 second. (ON for 0.1 second and OFF for 0.4 second)	BATTERY CAPACITY 00V/ 000%
Under	Long beep	SHUT DOWN DUE TO DEPLETED BATTERY

- **Bypass Mode**

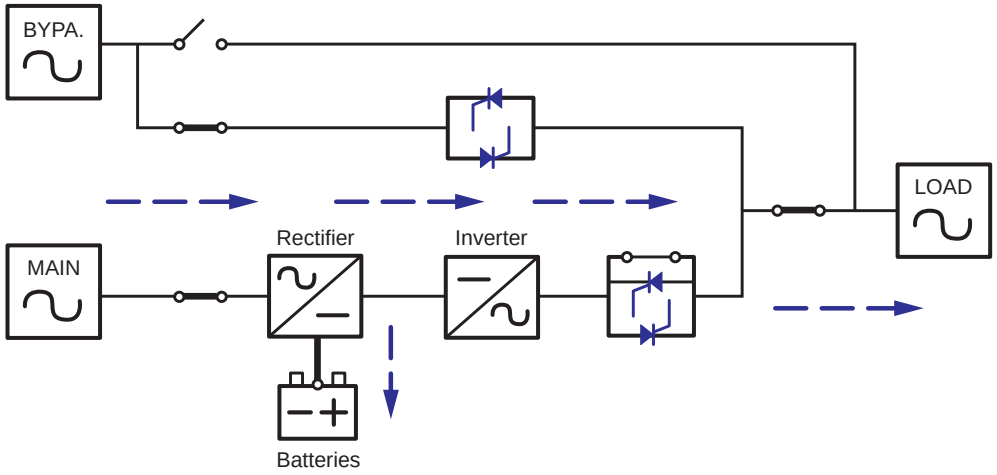
  The critical load is directly supplied by the utility power and the batteries are charged. During bypass mode, the BYPASS LED indicator (BYPASS) illuminates (yellow).



(Figure 4-5: Path of Electrical Power through the UPS in Bypass Mode)

- **Converter Mode**

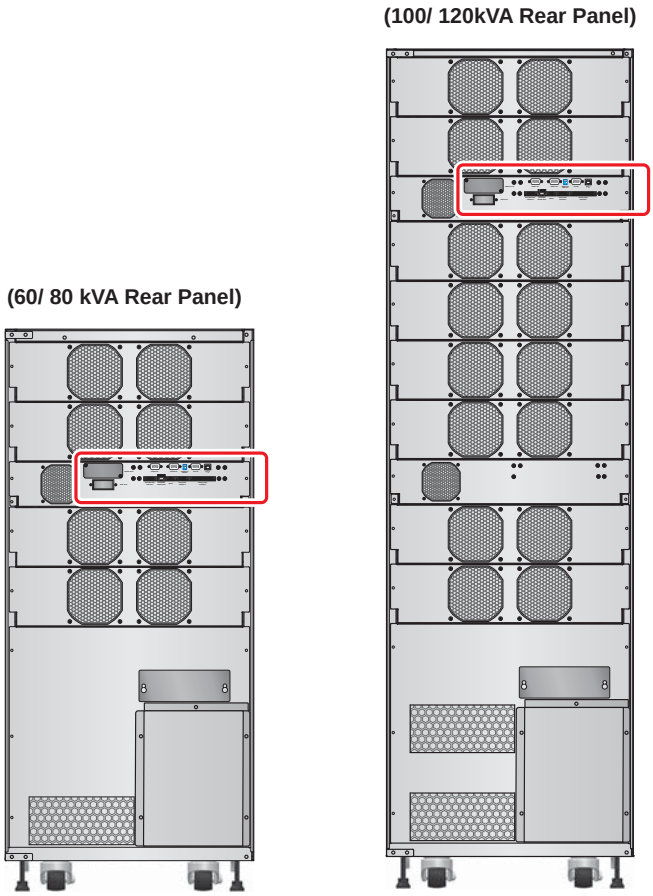
  When the UPS is manually set in converter mode, the output frequency can be set as 50Hz or 60Hz. After the output frequency is set up, the system will automatically disable the bypass function. Please note that once the inverter shuts down, there is no bypass output. During converter mode, the NORMAL LED indicator (NORMAL) illuminates (green).



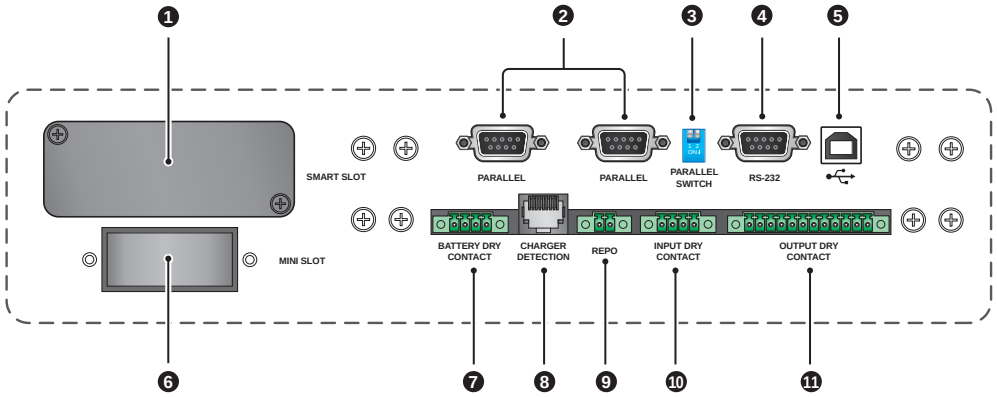
(Figure 4-6: Path of Electrical Power through the UPS in Converter Mode)

Chapter 5 : Communication Interfaces

For the positions and functions of the communication interfaces, please refer to the following description.



(Figure 5-1: Location of Communication Interfaces)



(Figure 5-2: Communication Interfaces)

NOTE:

1. The UPS can still function properly without making the connections below.
2. You can use all of the communication interfaces at the same time and it will not influence each interface's function.

❶ SMART Slot

Install an SNMP card in this SMART slot to remotely control and monitor the UPS status via a network. You can also insert the Relay I/O or ModBus card in this slot to let the UPS have dry contact and ModBus communication functions respectively.

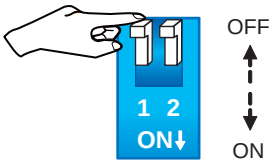
❷ Parallel Ports

The two parallel ports are for UPS parallel communication. UPSs (at maximum four) with the same capacity, voltage and frequency can be coupled via the provided parallel cable to run in parallel mode.

❸ Parallel Switch

When you parallel UPSs, you need to set up the parallel switch to activate parallel function. The parallel switch includes two DIP switches. To turn on a DIP switch, switch the DIP to the down position; to turn off a DIP switch, switch the DIP to the up position.

1. When two UPSs are paralleled, turn on each UPS's DIP switches.
2. When three UPSs are paralleled, turn off the middle UPS's DIP switches and turn on the remaining UPSs' DIP switches.
3. When four UPSs are paralleled, turn off the middle two UPSs' DIP switches and turn on the remaining UPSs' DIP switches.

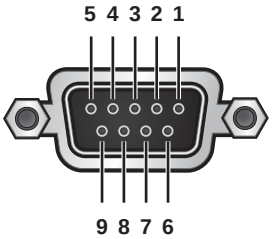


(Figure 5-3: Parallel Switch)

❹ RS-232 Port

The RS-232 port is built into the UPS rear panel to provide communication between the UPS and a computer. It also provides dry contact functions to output the UPS status. You can use the Delta UPSentry 2012 software (http://www.deltapowersolutions.com/en/mcis/software-center.php) to check and monitor the UPS status via a computer. Detailed information is as follows:

1. Monitors the load level, battery status, battery voltage, UPS operation mode, input voltage, input frequency, output voltage, and UPS temperature.
2. Sets shutdown delay time.
3. Enables/ disables beep.
4. Supports remote shutdown.
5. Pin Assignment:
   1) PIN 2: TXD <Transmitting Data>
   2) PIN 3: RXD <Receiving Data>
   3) PIN 5: GND <Signal Ground>



(Figure 5-4: RS232 Port)

6. Hardware
   1) Baud Rate: 2400 bps
   2) Data Length: 8 bit
   3) Stop Bit: 1 bit
   4) Parity: None

NOTE: Other pins are reserved and cannot be used.

❺ USB Port

Besides the RS-232 port, the UPS also provides another channel, USB port, for the user to use. The functions of the USB port are the same as those of the RS-232 port mentioned above. Simply plug the provided USB cable into the UPS and your computer, install the UPSentry 2012 software (included in the provided CD), and follow the prompts on your screen to complete the software installation.

NOTE: Do not use the RS-232 port and the USB port at the same time.

❻ MINI Slot

This MINI slot is for mini cards. You can install a Delta Mini SNMP, Mini Relay I/O, Mini USB, Mini ModBus, or Mini TVSS card in this slot to give the system network communication, dry contact, USB communication, ModBus communication, and surge protection functions respectively.

❼ Battery Dry Contact

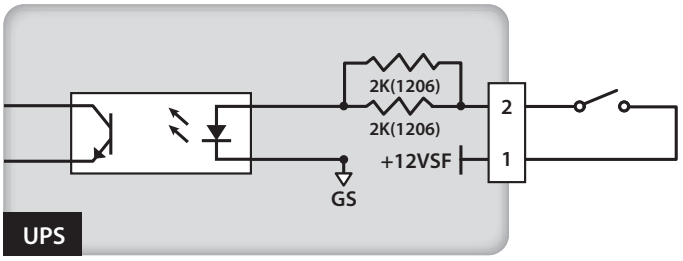
You can purchase the battery cabinet temperature sensor cable (optional) to detect the connected external battery cabinet's temperature. The sensor cable is able to simultaneously detect the temperature of the two strings (+ & -) of batteries installed in the external battery cabinet.

❽ Charger Detection Port

The charger detection port is used to connect with an external charger box. Via this port, the UPS can detect the operating status of the external charger box and control its switch.

❾ REPO Port

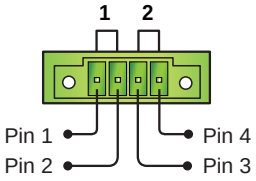
The REPO port is for remote emergency shutdown. When an emergency event occurs, it can disconnect the UPS power supply rapidly and shut down the UPS immediately. The configuration is shown as follows and it requires external power with a voltage range between 6~12Vdc.



(Figure 5-5: REPO Port Configuration)

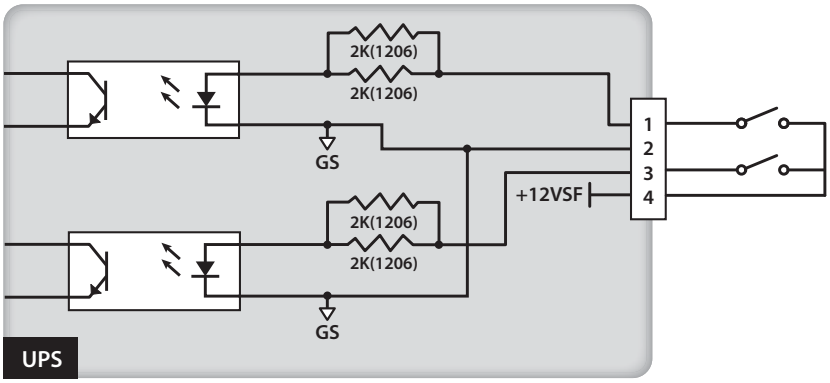
⑩ Input Dry Contacts

The HPH UPS provides two sets of input dry contacts and they are normally open. The default setting for Pin 1 & 2 is '**Remote ON/ OFF**' and the default setting for Pin 3 & 4 is '**Generator Power Supply Signal**'. There are two types of configurations.



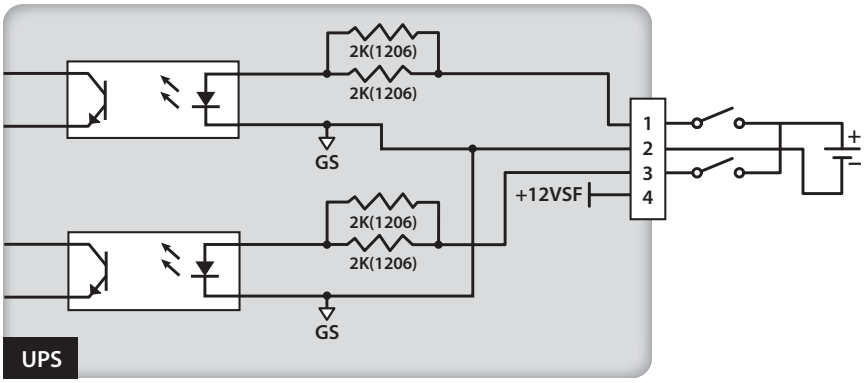
(Figure 5-6: Input Dry Contacts)

Figure 5-7 shows the 1st type of input dry contact configuration. It requires internal power, +12VSF.



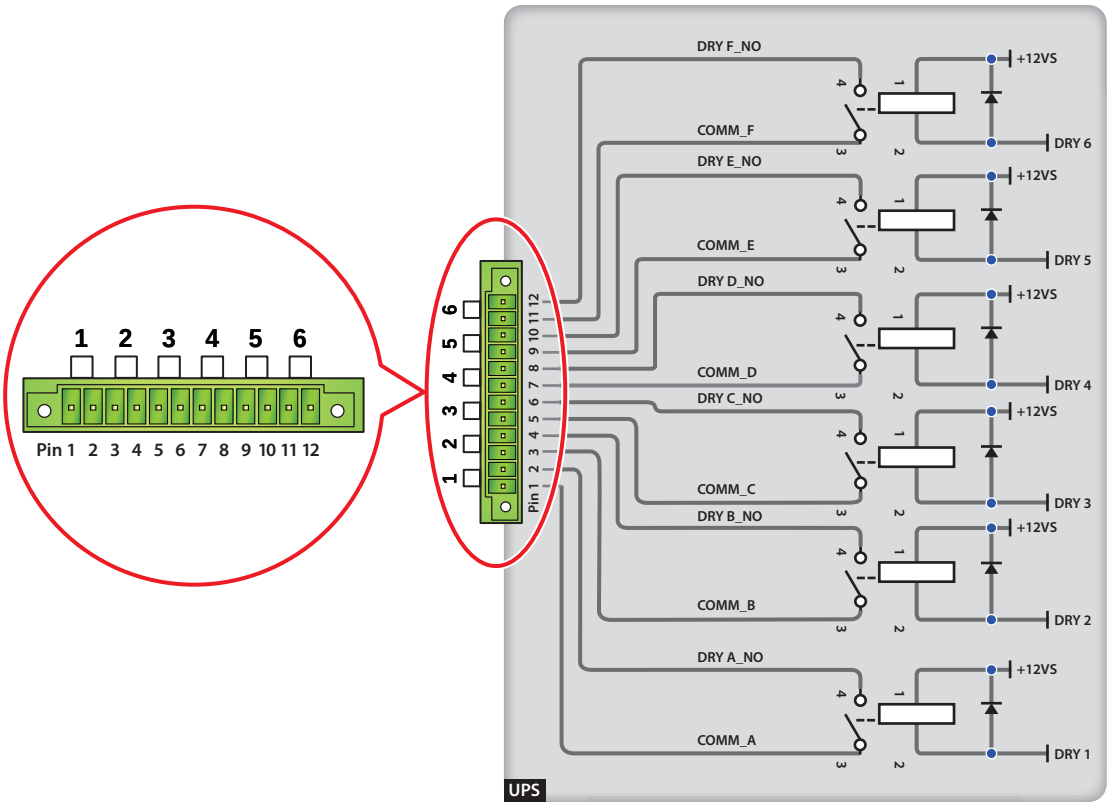
(Figure 5-7: Input Dry Contact Configuration I)

Figure 5-8 shows the 2nd type of input dry contact configuration. It requires external power with a voltage range between 6~12Vdc.



(Figure 5-8: Input Dry Contact Configuration II)

⓫ Output Dry Contacts



(Figure 5-9: Output Dry Contacts: Pin Definition and Design)

The HPH UPS provides six sets of programmable output dry contacts for you to receive UPS events. The output dry contacts are normally open. There are eighteen events for you to select, and you can choose six of them to set up the output dry contacts. Please refer to the table below.

No.	Event	Description
1	Load on inverter	1. The UPS works in normal mode. 2. Default: Pin 1 & 2
2	Load on bypass	1. The UPS works in bypass mode. 2. Default: Pin 3 & 4
3	Battery discharge/ Main input NOK	1. When the main AC source fails, it is the batteries to supply power to the equipment loads. 2. Default: Pin 5 & 6
4	Low battery	1. When the UPS runs in battery mode, battery voltage is lower than setup limit, 220Vdc. 2. Default: Pin 7 & 8
5	Bypass input NOK	1. The bypass voltage, frequency or phase sequence is abnormal. 2. Default: Pin 9 & 10
6	Battery test fail or battery missing	1. In the process of battery test, battery voltage is out of setup limit. 2. Default: Pin 11 & 12
7	Internal communication failure	Power unit's internal communication is abnormal.
8	External parallel communication loss	In parallel mode, parallel communication is abnormal.
9	Output overload warning/ shutdown	The UPS is overloaded or the UPS shuts down to let the bypass supply power to the equipment loads.
10	EPO activated	The **EPO** button is pressed to urgently power off the UPS.
11	Load on manual bypass	The Manual Bypass Breaker is turned on and the UPS transfers to manual bypass mode.
12	Battery cabinet over temperature warning/ shutdown	The external battery cabinet's temperature is too high.
13	Abnormal inverter voltage	The output voltage is too high or too low.
14	Battery needs replacement	Battery replacement date is due.
15	Bypass over temperature warning/ shutdown	Bypass static switch temperature is too high.
16	Bypass static switch fail	The bypass static switch has open/ short issue.
17	Over temperature fail	When the UPS temperature is out of range.
18	General alarm	When any of above-mentioned events occurs.

Chapter 6 : Installation and Wiring

6.1 Precautions Prior to Installation and Wiring

Due to different installation environments, it is highly recommended that you read this user manual before installation. Only authorized Delta engineers or service personnel can perform installation and maintenance. If you want to install the UPS by yourself, installation must be under the supervision of authorized Delta engineers or service personnel. If you use a forklift or other equipment to move the UPS, please make sure its load bearing is sufficient. For the weight of the UPS, please refer to ***Appendix 1 : Technical Specifications***.

6.2 Installation Environment

- Install the UPS indoors. Do not place it outdoors.
- Make sure that transportation routes (e.g. corridor, door gate, elevator, etc.) and installation area can accommodate and bear the weight of the UPS, external battery cabinets, other equipment that will be installed nearby and forklifts. For the weight of the UPS, please refer to ***Appendix 1 : Technical Specifications***.
- The installation place must be kept clean and tidy at all times.
- Ensure that the installation area is big enough for maintenance and ventilation. Since the fans of the UPS ventilate from front to rear, and it is recommended that you place the external battery cabinet next to the UPS, we suggest that you:
  1. Keep a distance of 100cm from the front of the UPS and the external battery cabinet for maintenance and ventilation.
  2. Keep a distance of 50cm from the back of the UPS and the external battery cabinet for maintenance and ventilation.
  3. Keep a distance of 50cm from the both sides of the UPS and the external battery cabinet for maintenance and ventilation.
- Keep the installation area's temperature around 0°C~40°C and humidity within 95%. The high-est operating altitude is 1000 meters above sea level.

WARNING:

Do not use air conditioners or similar equipment to blow into the rear side of the UPS and hinder ventilation.

6.3 UPS Transportation & Handling

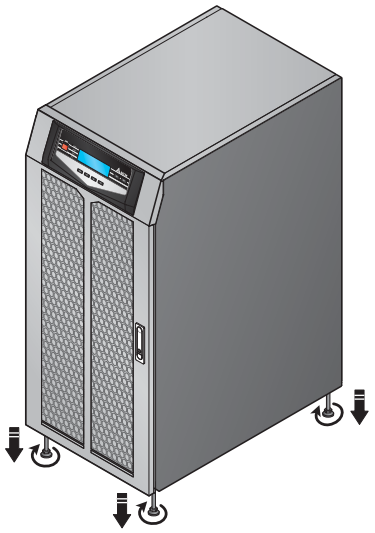
There are four casters at the bottom of the UPS. Please pay attention to the movement of the casters to avoid accidents when you remove the UPS from its pallet. The casters are designed to move on level ground. Do not move the UPS on an uneven surface. This might cause damage to the casters or tip the UPS which could damage the unit. If you need to move the UPS over a long distance, please use appropriate equipment like a forklift. Do not use the UPS casters to move the unit over a long distance.

6.4 UPS Installation & Fixing

NOTE:

The installation and fixing methods are the same for each 60/ 80kVA and 100/ 120 kVA model. In this chapter, only 60/ 80kVA model is used to illustrate the installation and fixing procedures.

1. Move the UPS to its final installation area and use the levelers to stabilize the UPS cabinet on the ground.

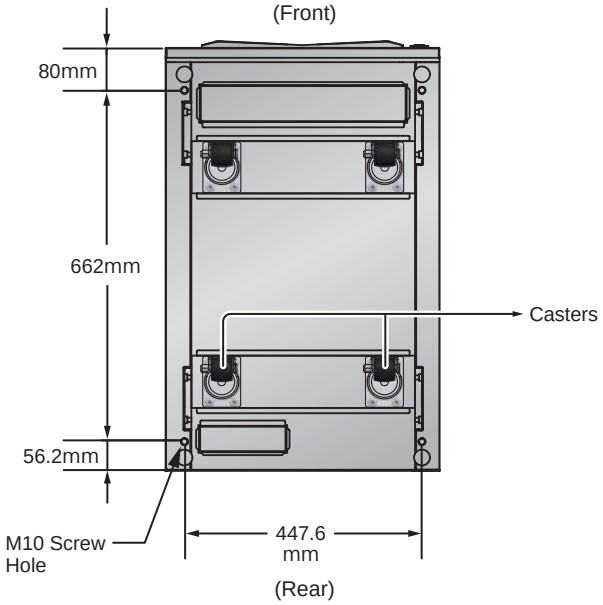


(Figure 6-1: Stabilize the UPS with Levelers)

2. There are two installation methods. One is with the balance supports, and the other is without the balance supports. Please refer to the following.

   - **Installation without the Balance Supports**

     After you decide the installation area, follow ***Figure 6-2*** to drill holes on the installation ground. M10 screws with length above 95mm are required.

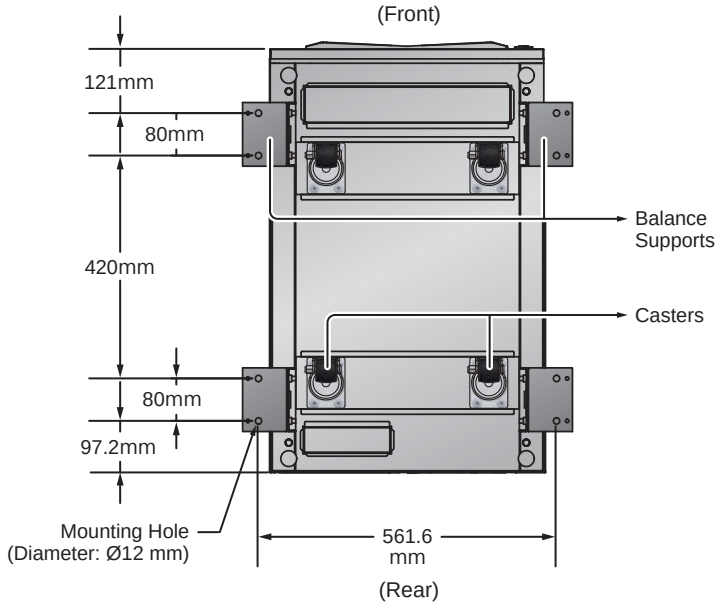


(Figure 6-2: UPS Cabinet Fixing Hole Diagram)

- **Installation with the Balance Supports**

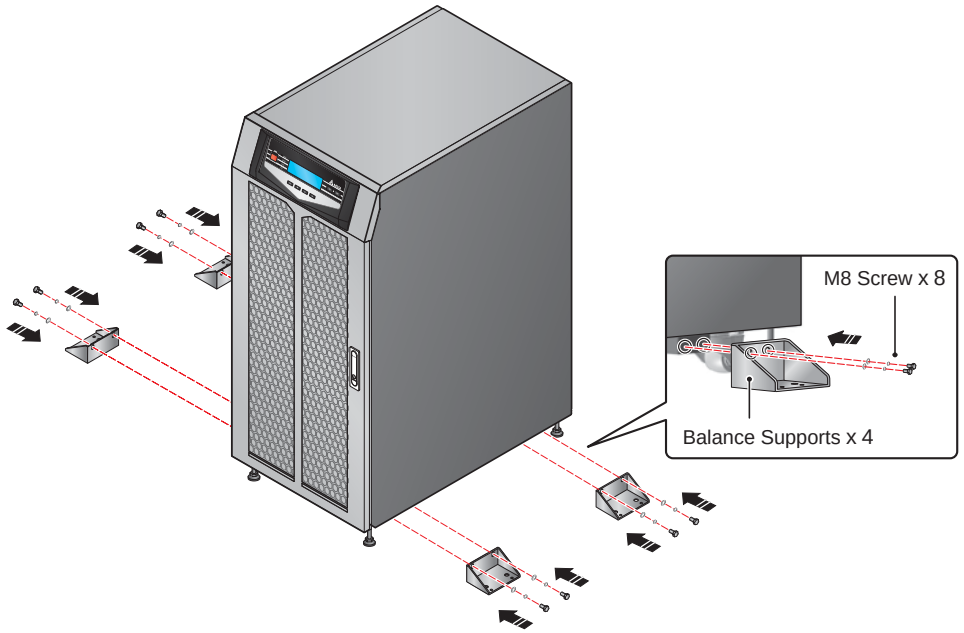
  Reinstall the balance supports (that have been removed from the UPS during the unpacking process) on the UPS. Please refer to the following procedures.

  1 After you decide the installation area, follow ***Figure 6-3*** to drill holes on the installation ground.



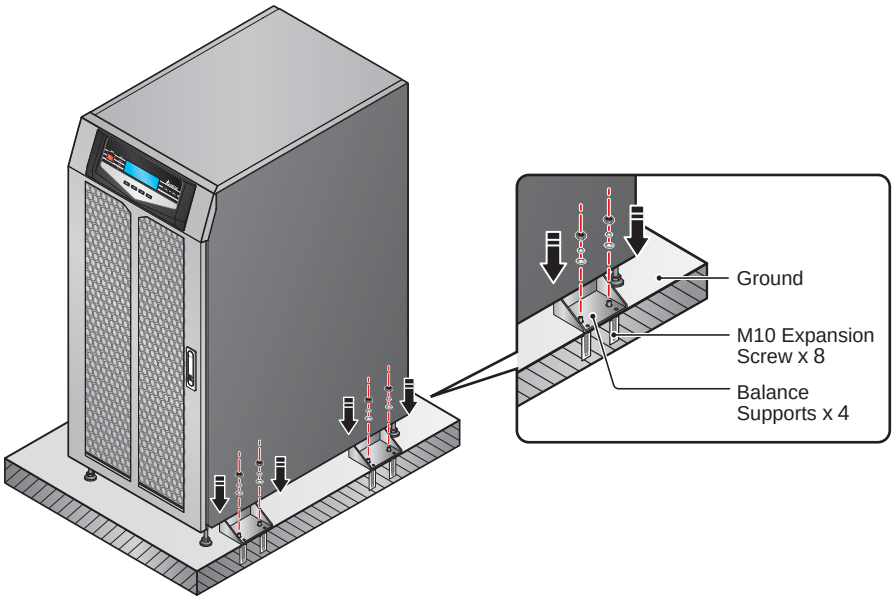
(Figure 6-3: Mounting Hole Diagram)

2 Move the UPS on the installation ground that you have drilled holes, use the levelers to stabilize the UPS on the ground and use the M8 screws to reinstall the balance supports (that have been removed from the UPS during the unpacking process) on the UPS. Please refer to the figure below.



(Figure 6-4: Balance Support Installation)

3 Use four M10 expansion screws to fix the four balance supports on the ground to avoid UPS movement. Please note that service personnel should provide the expansion screws. Please refer to the figure below.



(Figure 6-5: Fix the Balance Supports on the Ground)

6.5 Wiring

6.5.1 Precautions Prior to Wiring

- The wiring must be performed by qualified professional personnel. If you want to install the UPS by yourself, installation must be under the supervision of authorized Delta engineers or service personnel.
- Before wiring or making any electrical connection, make sure the power supplied to the input and output of the UPS is completely cut off.
- When connecting the UPS to the utility AC power, you must install a protective device and a contactor that meet safety certifications; please refer to the table below. The contactor's current must be equal to or larger than the current of the breaker shown in the table below, and the coil voltage shall be from the input voltage. For installation of the protective device, please refer to ***Figure 6-9~6-14***.

NOTE:

1. Regarding ***Figure 6-9~6-14***, each figure represents that the utility AC power is the TN system and a 3-pole protective device is installed between the UPS and the utility AC power. If your utility AC power is the TT system, please install a 4-pole protective device between the UPS and the utility AC power.
2. When the utility AC power is the TN system, a 3-pole protective device and a 3-pole contactor must be installed between the UPS and the utility AC power.
3. When the utility AC power is the TT system, a 4-pole protective device and a 4-pole contactor must be installed between the UPS and the utility AC power.

UPS	Suggested Protective Device	Suggested Supplier
60kVA	D-Curve 125A Breaker	Input & Bypass: CHINT (CB-125-4P)
80kVA	MCCB 160A Breaker	Input & Bypass: SHIHLIN (CN 4P160A)
100kVA	MCCB 200A Breaker	Input & Bypass: SHIHLIN (CN 4P200A)
120kVA	MCCB 225A Breaker	Input & Bypass: SHIHLIN (CN 4P225A)

- When connecting the UPS to the critical loads, you must install a 3-pole EN 60947-2 certified breaker between them. Please refer to the table below.

UPS	Suggested Protective Device	Suggested Supplier
60kVA	D-Curve 125A Breaker	Output: CHINT (CB-125-3P)
80kVA	MCCB 160A Breaker	Output: SHIHLIN (CN 3P160A)
100kVA	MCCB 200A Breaker	Output: SHIHLIN (CN 3P200A)
120kVA	MCCB 225A Breaker	Output: SHIHLIN (CN 3P225A)

- Check that the size, diameter, phase, and polarity of each cable that needs connecting to the UPS is correct. For the specifications of input/ output cables and circuit breakers, please refer to ***Table 6-1***.

Table 6-1: Specifications of Input/ Output Cables and Circuit Breakers

Capacity (kVA)	60kVA	80kVA	100kVA	120kVA
AC Input cable	0AWG × 1PC	2AWG × 2PCS	1AWG × 2PCS	0AWG × 2PCS
Output cable	0AWG × 1PC	2AWG × 2PCS	1AWG × 2PCS	0AWG × 2PCS
Battery cable	00AWG × 1PC	1AWG × 2PCS	0AWG × 2PCS	00AWG × 2PCS
Tightening Torque	M8= 150Kgf.cm; M10=250Kgf.cm			
Input Breaker	125A (3-pole×1)	160A (3-pole×1)	200A (3-pole×1)	225A (3-pole×1)
Output Breaker (The default is a 3-pole output breaker. An alternative of a 4-ploe one could be installed according to customer's requirement.)	125A (3-pole×1)	160A (3- pole×1)	200A (3-pole×1)	225A (3-pole×1)
Manual Bypass Breaker	125A (3-pole×1)	160A (3-pole×1)	200A (3-pole×1)	225A (3-pole×1)

NOTE:

1. In accordance with **National Electrical Codes (NEC)**, please install a suitable conduit and bushing.
2. Please refer to national and local electrical codes for acceptable non-fuse breakers and cable size.
3. Cables with PVC material and with temperature resistance up to 105°C are suggested.
4. Make sure that the input/ output cables are locked tightly.

- When connecting with the external battery cabinet, please confirm the polarity. Do not reverse the polarity.
- The grounding cable of the external battery cabinet must be connected to the (⏚) terminal of the battery terminal block.
- The UPS default setting is single input. If there is an intention to change the UPS into dual input or hot standby redundancy configuration, please contact qualified service personnel. Please check whether the electric potential of the neutral line (N) of the bypass source is the same as that of the neutral line (N) of the main AC source. If they do not share a common neutral line system, add an isolation transformer to the bypass source.
- The input of the UPS must be a Y connection, and the neutral line (N) must be connected to avoid UPS failure. Do not connect the neutral line (N) of the UPS with the ground terminal (⏚).
- If there is a floating voltage between the input power's neutral (N) and the ground (⏚), and you require that the VNG of the UPS should be zero, we suggest that you install an isolation transformer in front of the input side of the UPS, and connect the UPS neutral (N) with the ground (⏚).
- The utility AC power must be three phases (R/ S/ T) and meet the specifications specified on the UPS's rating label. When connecting the utility input power to the UPS, make sure it is in positive phase sequence.
- Connect the external battery cabinet's grounding terminal to the grounding terminal (⏚) of the UPS's battery terminal block. Do not connect the grounding terminal of the external battery cabinet to any other grounding system.
- The ground terminal (⏚) of the UPS must be grounded, and please use ring-type terminal for wiring.

WARNING:

1. Incorrect wiring will lead to severe electric shock and damage to the UPS.
2. The UPS will not work normally if the input power's neutral (N) is not firmly connected or not connected to the AC Input Block's neutral (N) terminal.

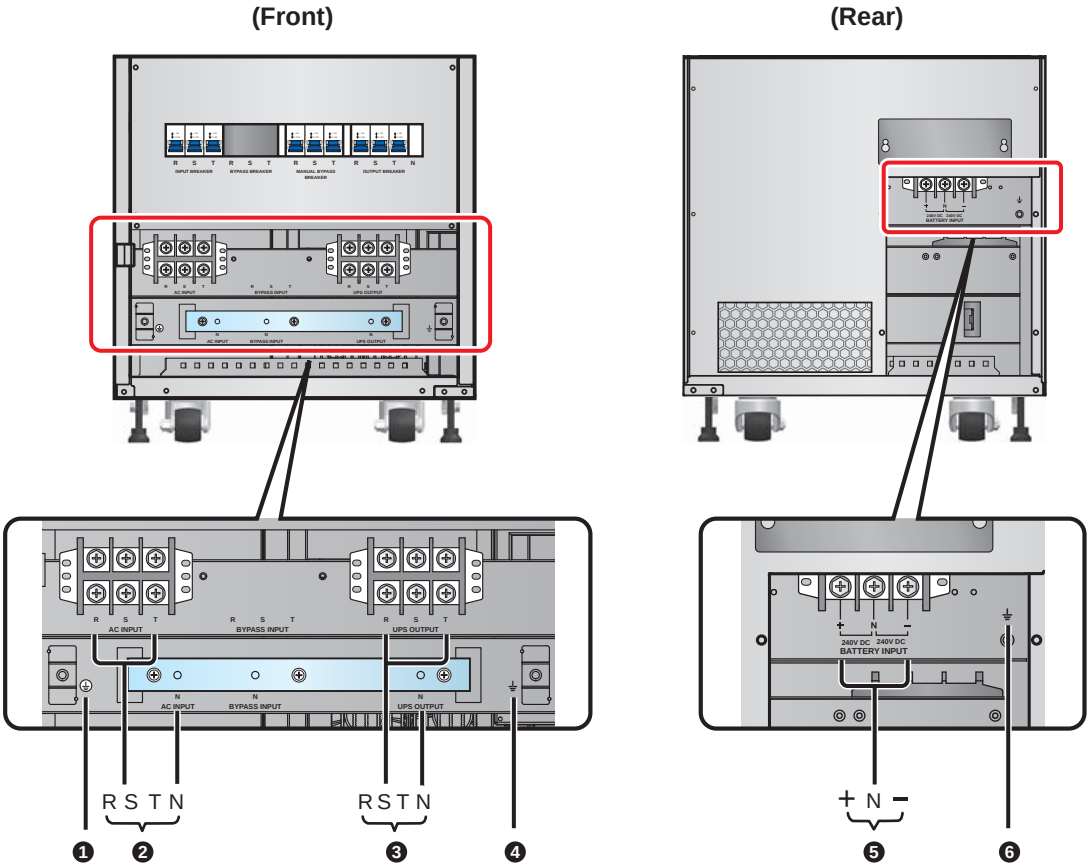
6.5.2 Single Unit Wiring

NOTE: Prior to wiring, please read ***6.5.1 Precautions Prior to Wiring*** first.

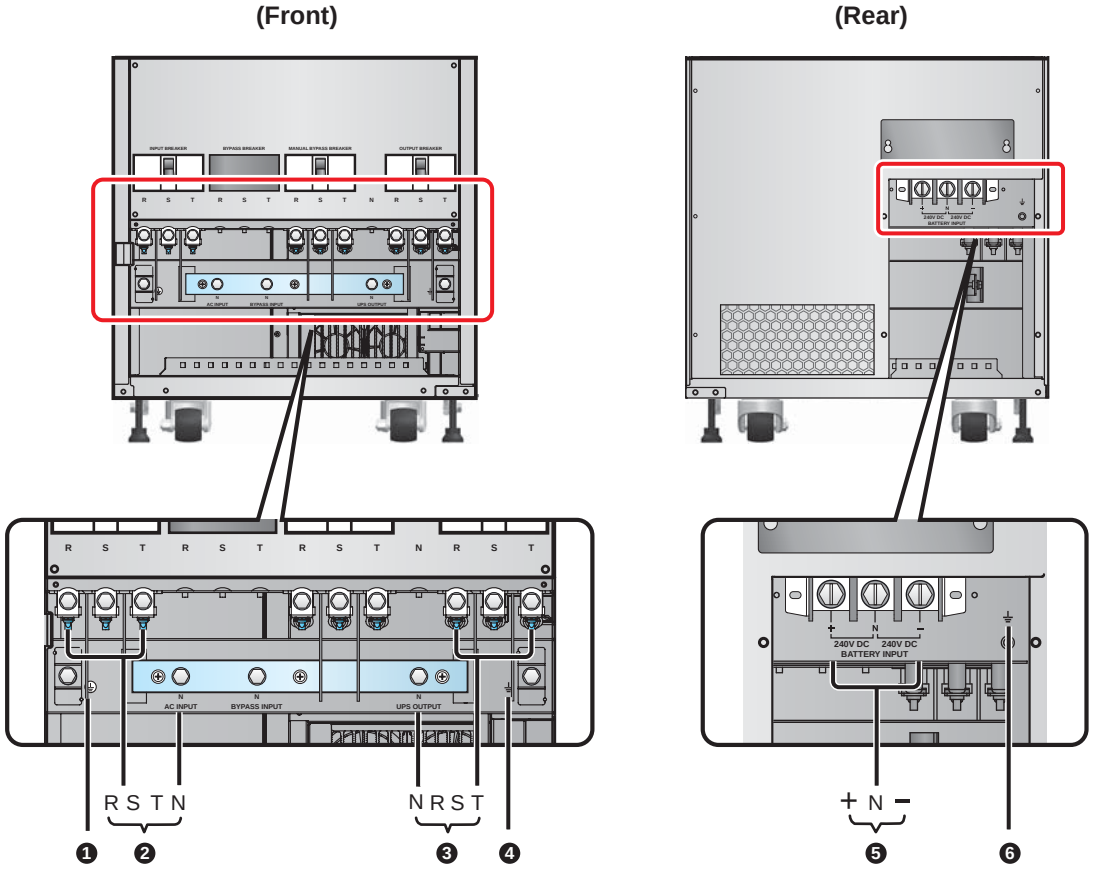
- **Single Input (Single Unit)**

  When there is only one AC power source, single unit wiring procedures are as follows.

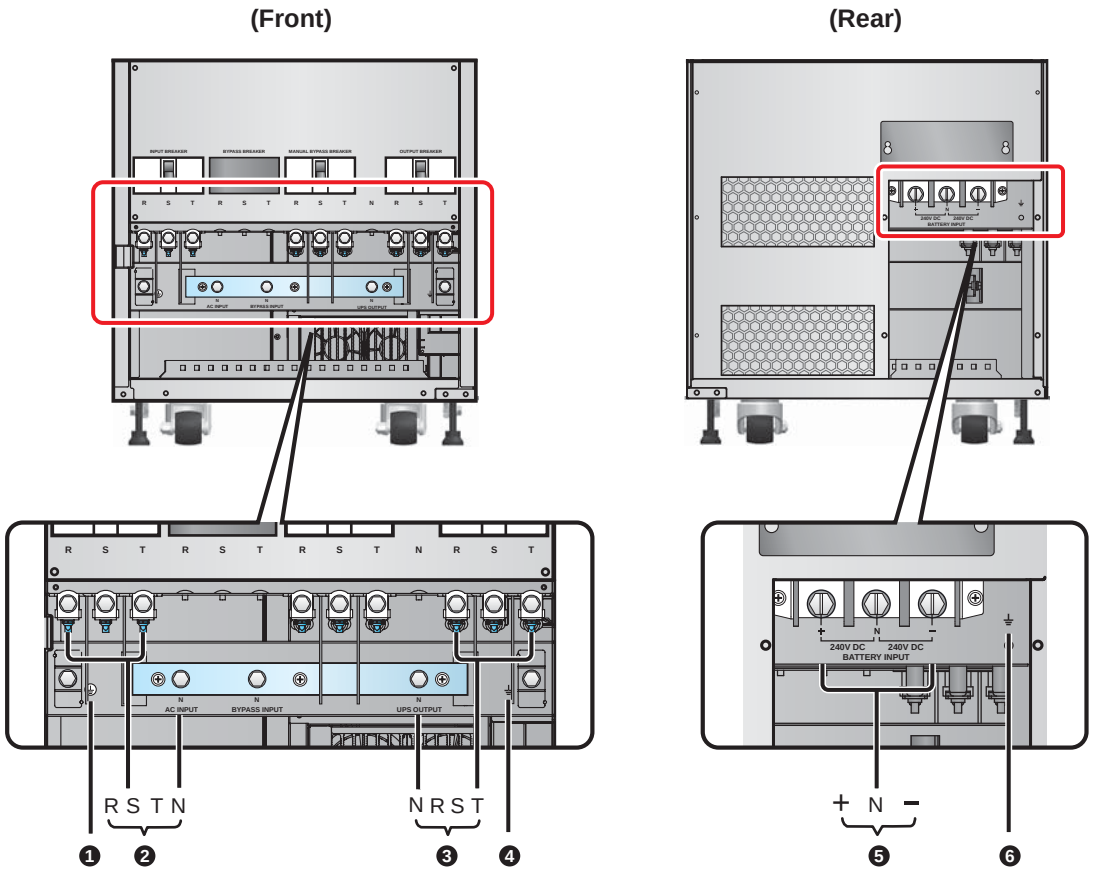
  1 Open the UPS's front door, remove the front and rear panels, and you will see the wiring terminal block shown in ***Figure 6-6~6-8***.



(Figure 6-6: 60kVA Model - Wiring Terminal Block)



(Figure 6-7: 80kVA Model - Wiring Terminal Block)



(Figure 6-8: 100/ 120kVA Model - Wiring Terminal Block)

2 Please ensure you understand the functions of the wiring terminal block shown in ***Figure 6-6~6-8***.

No.	Item	Function	Description
❶	⏚	For the UPS grounding	Includes one grounding terminal.
❷	AC Input Terminal Block	Connects the main AC source.	Includes three-phase (R, S, T) and neutral (N) terminals.
❸	UPS Output Terminal Block	Connects the critical loads.	Includes three-phase (R, S, T) and neutral (N) terminals.
❹	⏚	For the critical loads' grounding	Includes one grounding terminal.
❺	Battery Input Terminal Block	Connects an external battery cabinet.	Includes three terminals, posi-tive (+), negative (-) and neutral (N).
❻	⏚	For the external battery cabinet's grounding	Includes one grounding terminal.

3 The UPS rating voltage is 220/ 380Vac, 230/ 400Vac or 240/ 415Vac, and the battery rating voltage is ±240Vdc.

4 Confirm the input breaker in the **OFF** position.

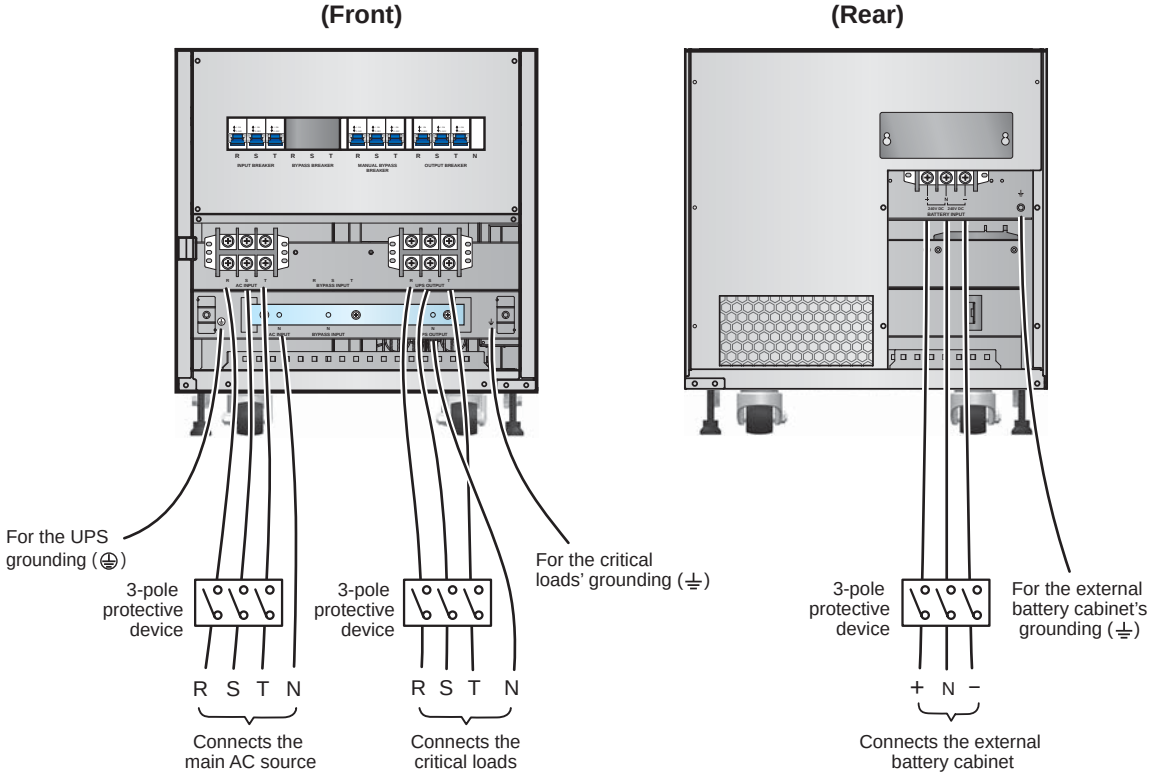
5 According to the capacity and the model of your UPS, select proper input and output cables (please refer to ***Table 6-1***).

6 Connect the main AC source/ output/ external battery cabinet cables to the wiring terminal block (please refer to ***Figure 6-9~6-11***).

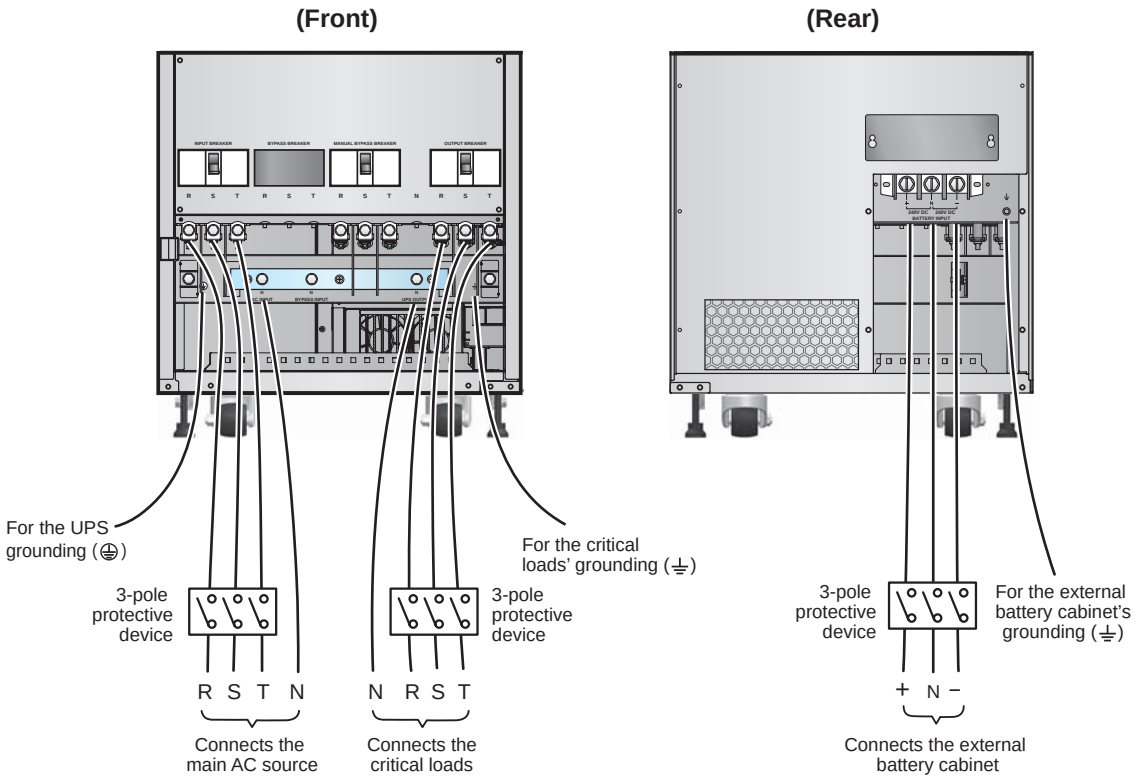
NOTE:

1. Regarding ***Figure 6-9~6-11***, each figure represents that the utility AC power is the TN system and a 3-pole protective device is installed between the UPS and the utility AC power. If your utility AC power is the TT system, please install a 4-pole protective device between the UPS and the utility AC power.
2. When the utility AC power is the TN system, a 3-pole protective device and a 3-pole contactor must be installed between the UPS and the utility AC power.
3. When the utility AC power is the TT system, a 4-pole protective device and a 4-pole contactor must be installed between the UPS and the utility AC power.

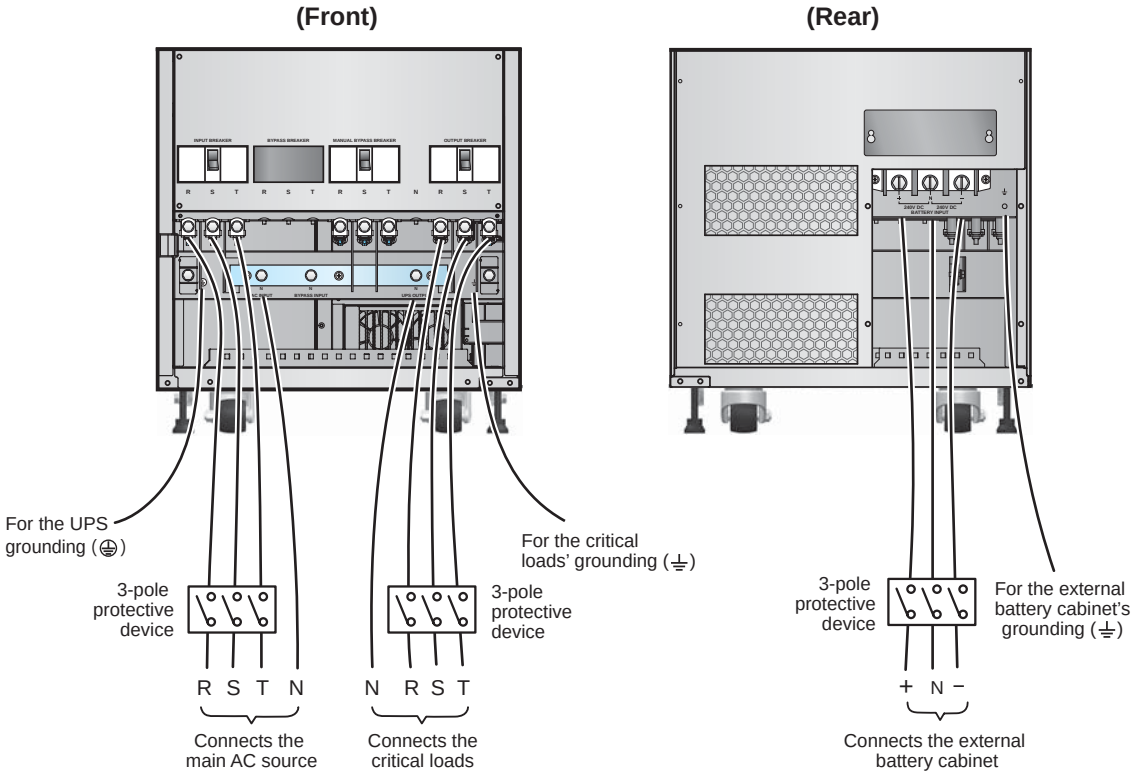
7 Ground the UPS.



(Figure 6-9: 60kVA Model - Single Unit Single Input Wiring Diagram)



(Figure 6-10: 80kVA Model - Single Unit Single Input Wiring Diagram)



(Figure 6-11: 100/ 120kVA Model - Single Unit Single Input Wiring Diagram)

- **Dual Input (Single Unit)**

  When there are two AC power sources, single unit wiring procedures are as follows.

  1 Please contact qualified service personnel to modify the UPS into dual input. Please note that only qualified service personnel can modify single input/ dual input setup.

  2 Please follow steps 1 ~ 5 stated in section ***Single Input (Single Unit)***.

  3 Ensure that the input breaker and bypass breaker are in the **OFF** position.

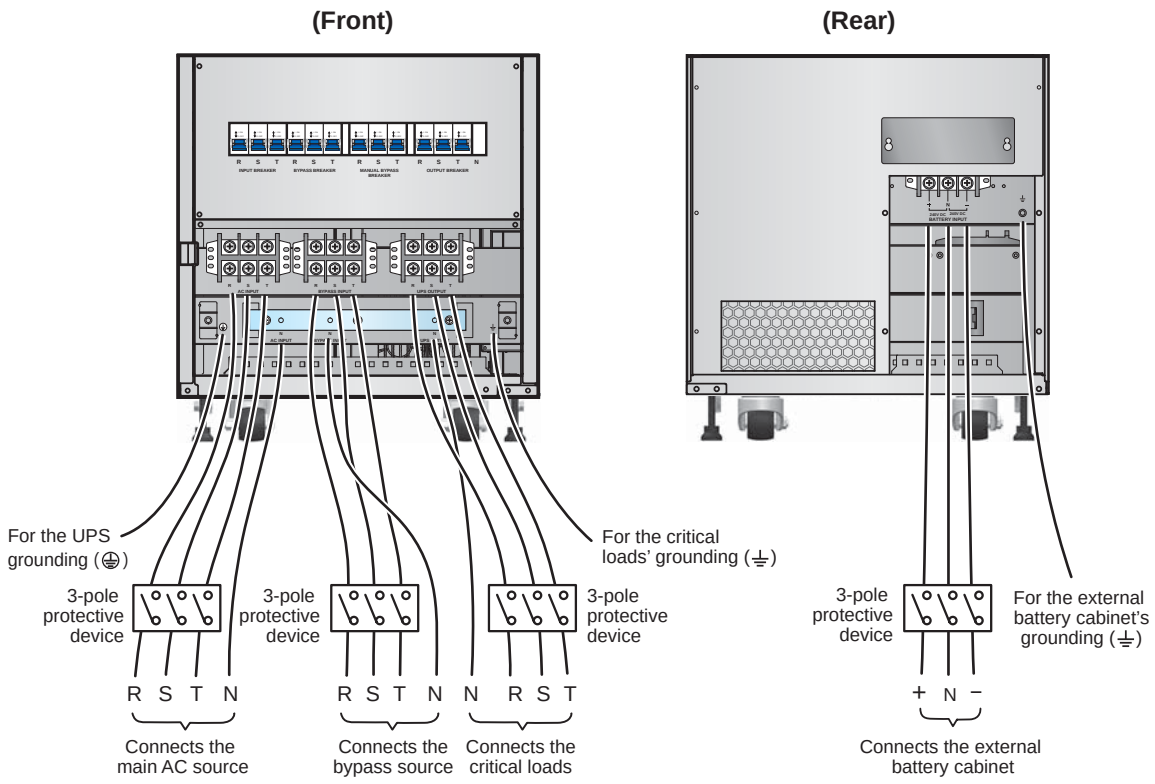
  4 According to the capacity and the model of your UPS, select proper input and output cables. Please refer to ***Table 6-1***.

  5 Connect the main AC source/ bypass source/ output/ external battery cabinet cables to the wiring terminal block (please refer to ***Figure 6-12~6-14***).

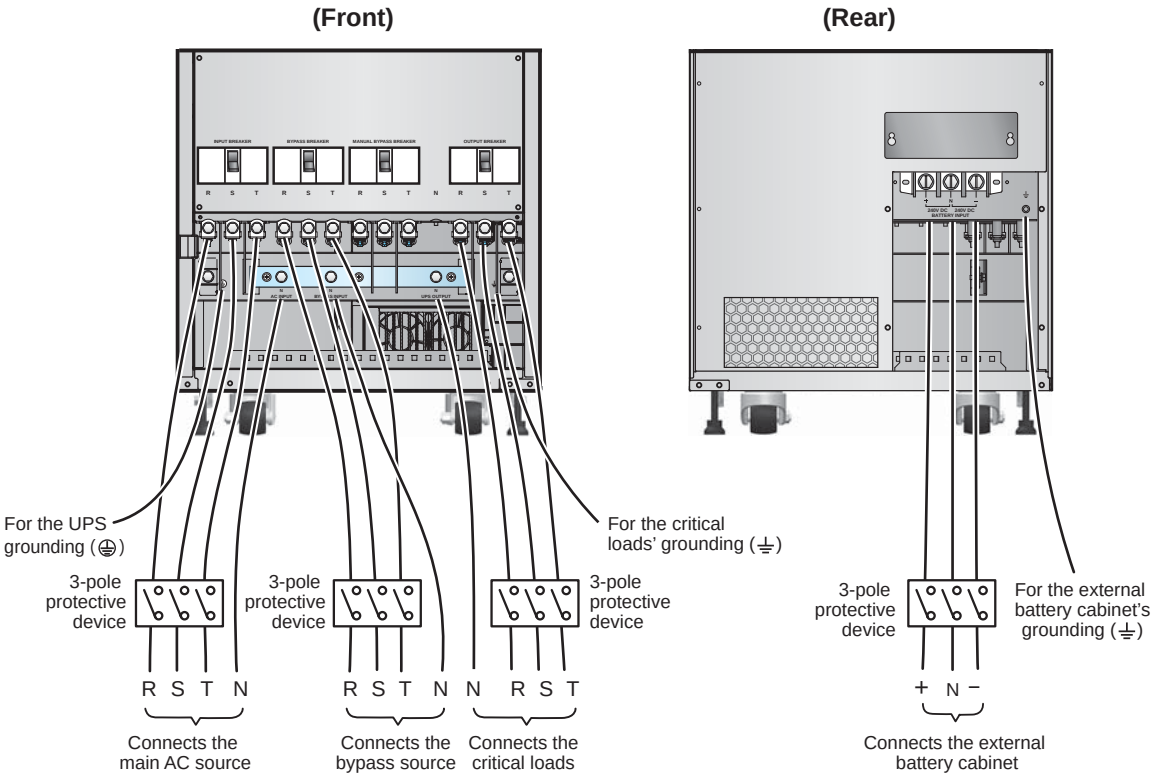
  NOTE:

  1. Regarding ***Figure 6-12~6-14***, each figure represents that the utility AC power is the TN system and a 3-pole protective device is installed between the UPS and the utility AC power. If your utility AC power is the TT system, please install a 4-pole protective device between the UPS and the utility AC power.
  2. When the utility AC power is the TN system, a 3-pole protective device and a 3-pole contactor must be installed between the UPS and the utility AC power.
  3. When the utility AC power is the TT system, a 4-pole protective device and a 4-pole contactor must be installed between the UPS and the utility AC power.

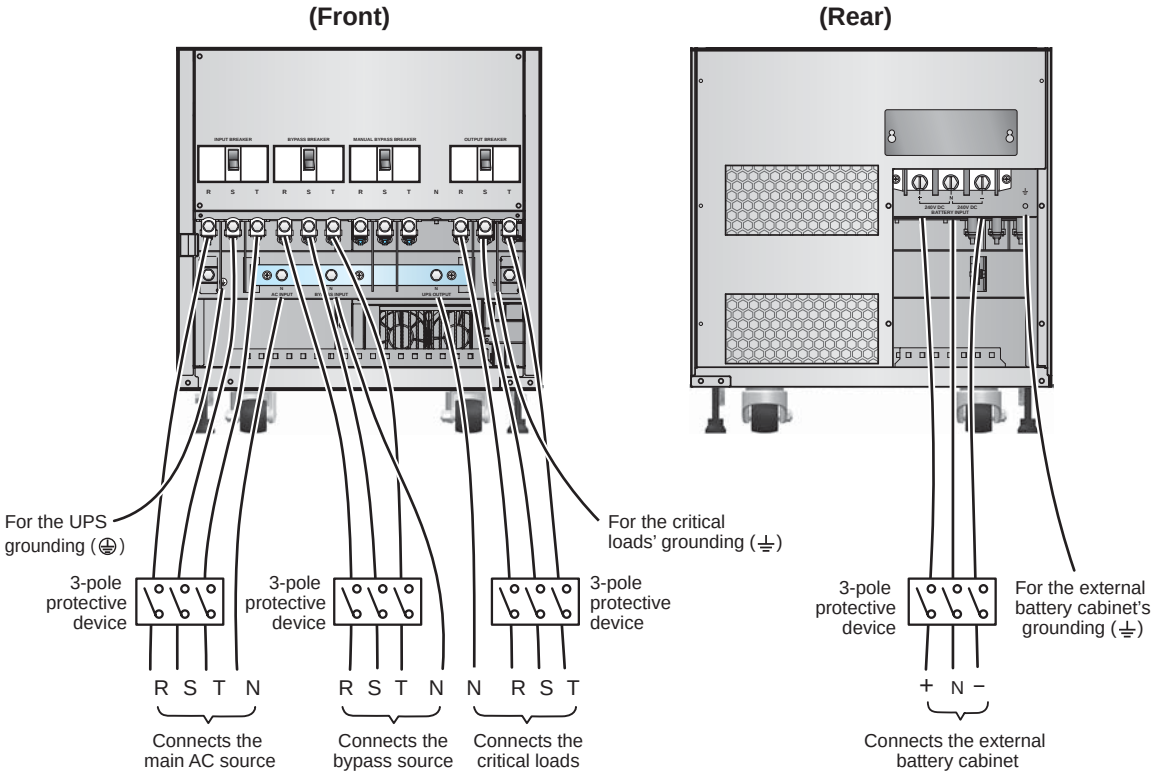
  6 Ground the UPS.



(Figure 6-12: 60kVA Model - Single Unit Dual Input Wiring Diagram)



(Figure 6-13: 80kVA Model - Single Unit Dual Input Wiring Diagram)



(Figure 6-14: 100/ 120kVA Model - Single Unit Dual Input Wiring Diagram)

6.5.3 Parallel Units Wiring

NOTE: Prior to wiring, please read ***6.5.1 Precautions Prior to Wiring*** first.

- **Single Input (Parallel Units)**

  When there is only one AC power source, parallel unit's wiring procedures are as follows.

  〔1〉 Please follow steps 〔1〉 ~ 〔5〉 stated in section ***Single Input (Single Unit)***.

  〔2〉 Connect the main AC source/ output/ external battery cabinet cables to the wiring terminal block (please refer to ***Figures 6-9~6-11/ 6-15***).

NOTE:

1. Regarding ***Figure 6-9~6-11***, each figure represents that the utility AC power is the TN system and a 3-pole protective device is installed between the UPS and the utility AC power. If your utility AC power is the TT system, please install a 4-pole protective device between the UPS and the utility AC power.
2. When the utility AC power is the TN system, a 3-pole protective device and a 3-pole contactor must be installed between the UPS and the utility AC power.
3. When the utility AC power is the TT system, a 4-pole protective device and a 4-pole contactor must be installed between the UPS and the utility AC power.

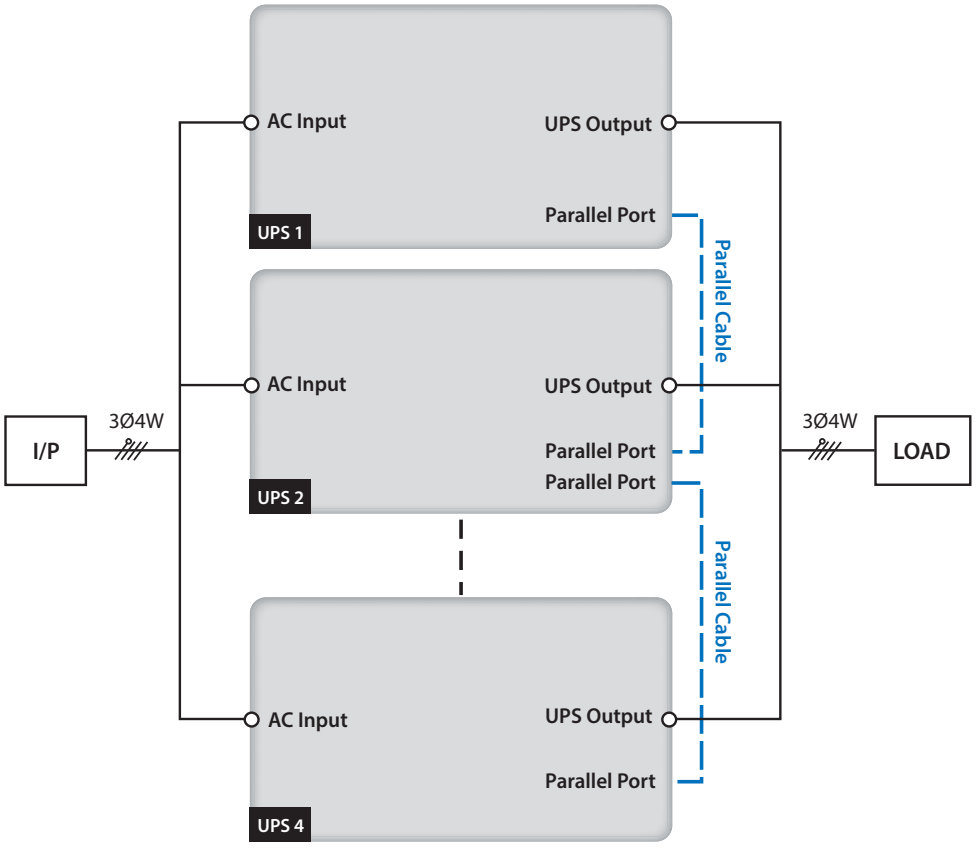
3 Use the provided parallel cable to connect the parallel ports on the parallel units. Please see ***Figure 5-2*** for parallel port location.

4 Please refer to ***Chapter 5 : Communication Interfaces*** to set the parallel switch in the **ON** or **OFF** position.

5 Ground the parallel UPSs.

WARNING:

1. When UPSs are paralleled, the length of each unit's input cables/ output cables must be equal. This ensures that the parallel UPSs can equally share the equipment loads in bypass mode.
2. Only UPSs with the same capacity, voltage and frequency can be paralleled; otherwise, parallel functions will fail.
3. Before start-up of parallel units, qualified service personnel should set ID (0, 1, 2 or 3) through LCD. Otherwise, UPSs can not be started.



(Figure 6-15: Parallel Units Single Input Wiring Diagram)

- **Dual Input (Parallel Units)**

  When there are two AC power sources, parallel units' wiring procedures are as follows.

  1. Please contact qualified service personnel to modify the UPS into dual input. Please note that only qualified service personnel can modify single input/ dual input setup.
  2. Please follow steps 1 ~ 5 stated in section ***Single Input (Single Unit)***.
  3. Ensure that the input breaker and bypass breaker are in the **OFF** position.
  4. According to the capacity and the model of your UPS, select proper input and output cables. Please refer to ***Table 6-1***.
  5. Connect the main AC source/ bypass source/ output/ external battery cabinet cables to the wiring terminal block (please refer to ***Figures 6-12~6-14/ 6-16***).

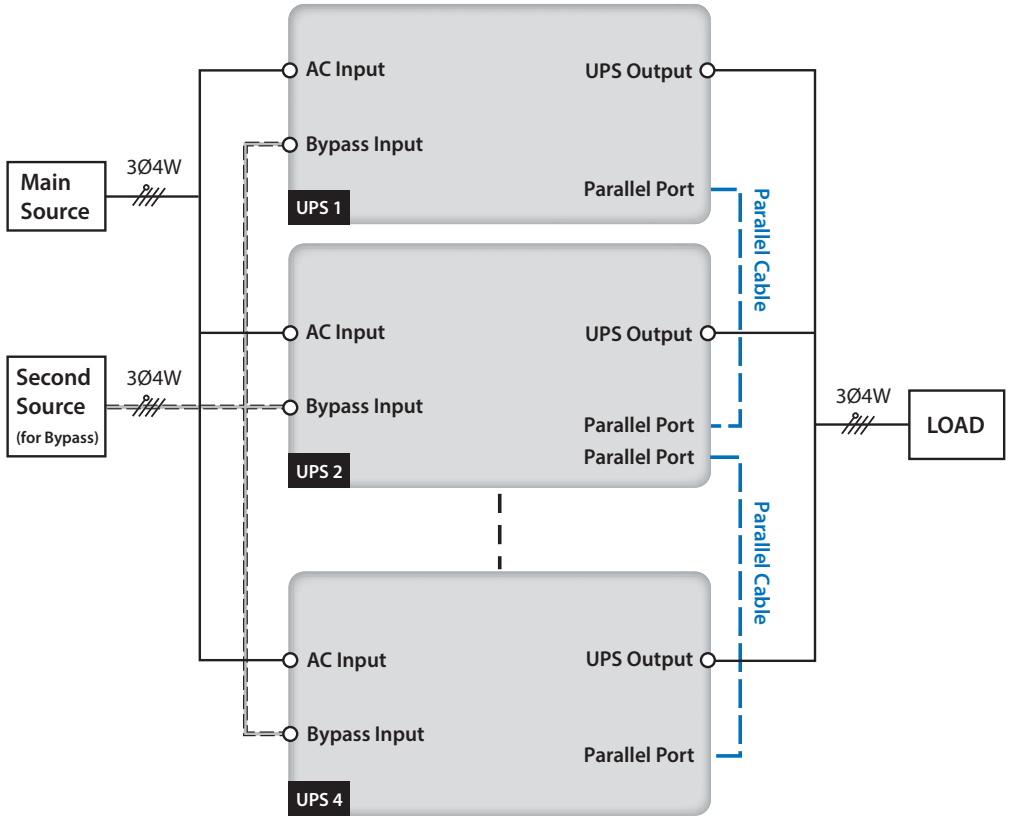
  NOTE:

  1. Regarding ***Figure 6-12~6-14***, each figure represents that the utility AC power is the TN system and a 3-pole protective device is installed between the UPS and the utility AC power. If your utility AC power is the TT system, please install a 4-pole protective device between the UPS and the utility AC power.
  2. When the utility AC power is the TN system, a 3-pole protective device and a 3-pole contactor must be installed between the UPS and the utility AC power.
  3. When the utility AC power is the TT system, a 4-pole protective device and a 4-pole contactor must be installed between the UPS and the utility AC power.

  6. Use the provided parallel cable to connect the parallel ports on the parallel units. Please see ***Figure 5-2*** for parallel port location.
  7. Please refer to ***Chapter 5 : Communication Interfaces*** to set the parallel switch in the **ON** or **OFF** position.
  8. Ground the parallel UPSs.

  WARNING:

  1. When UPSs are paralleled, the length of each unit's input cables/ output cables must be equal. This ensures that the parallel UPSs can equally share the equipment loads in bypass mode.
  2. Only UPSs with the same capacity, voltage and frequency can be paralleled; otherwise, parallel functions will fail.
  3. Before start-up of parallel units, qualified service personnel should set ID (0, 1, 2 or 3) through LCD. Otherwise, UPSs can not be started.



(Figure 6-16: Parallel Units Dual Input Wiring Diagram)

6.6 External Battery Cabinet Connection Precautions

WARNING:

You can connect loads to the UPS only after the batteries are fully charged. This guarantees that the UPS can provide sufficient backup power to the loads connected when a power failure occurs.

- **Battery**

  1. Charge Voltage

     1) Float voltage: ±272Vdc (default)

     2) Boost voltage: ±280Vdc (default)

2. Charge Current

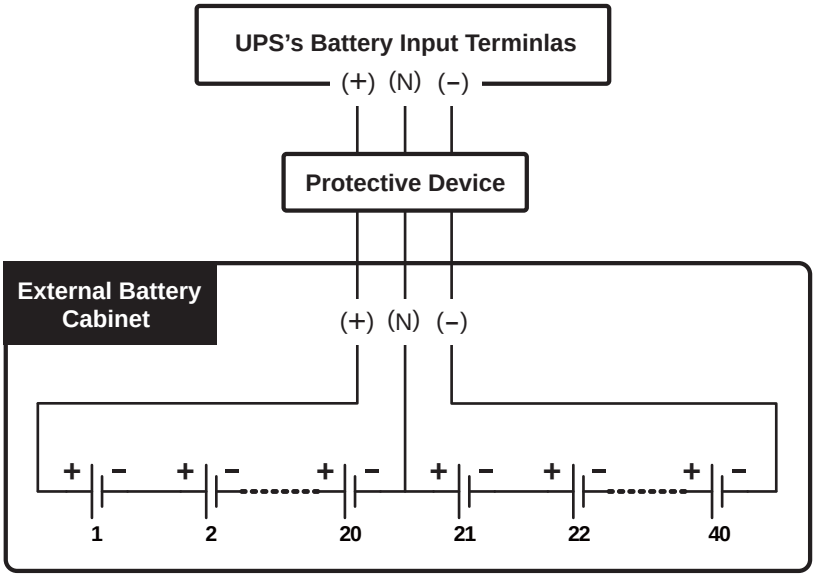
UPS	Default	Minimum	Maximum
60kVA	10A	2A	10A (can be expanded to 20A according to customer's requirement)
80kVA	15A	2A	15A (can be expanded to 20A according to customer's requirement)
100kVA	20A	2A	20A (can be expanded to 40A according to customer's requirement)
120kVA			

3. Low Battery Shutdown: 210Vdc (default: 210Vdc)
4. The Number of Batteries: Default_12Vdc x 40 pcs (±20 pcs); Tolerance_12Vdc x 36pcs (±18 pcs) ~ 46pcs (±23 pcs).

NOTE:

1. You can adjust the charge current from 2A to the maximum. Each adjustment level is 0.5A.
2. If you need to modify the charge current default setting and low battery shutdown default setting, please contact your local dealer or service personnel.

- Only use the same type of batteries from the same supplier. Never use old, new and different Ah batteries at the same time.
- The number of batteries must meet UPS requirements.
- Do not connect the batteries in reverse.
- Use the voltage meter to measure whether the total voltage, after the external battery cabinet connection, is around 12.5Vdc × the total number of batteries.
- To extend battery backup time, you can connect several external battery cabinets to the UPS. Please note that the number of the batteries in each paralleled external battery cabinet must be the same.
- The default number of batteries is 40 pcs of 12V batteries connected in string, and you should connect the external battery cabinet's neutral to the middle 20th and 21st batteries. You should use three cables to connect the external battery cabinet with the '+', '-' and 'N' terminals marked on the UPS. Please refer to ***Figure 6-17***.



(Figure 6-17: External Battery Cabinet Connection)

- Please follow your UPS's rating to install an appropriate protective device for the external battery cabinet. You can choose to install either an isolated switch connected in series with a DC fuse or a DC circuit breaker. Please refer to ***Table 6-2***.

Table 6-2: External Battery Cabinet's Protective Device

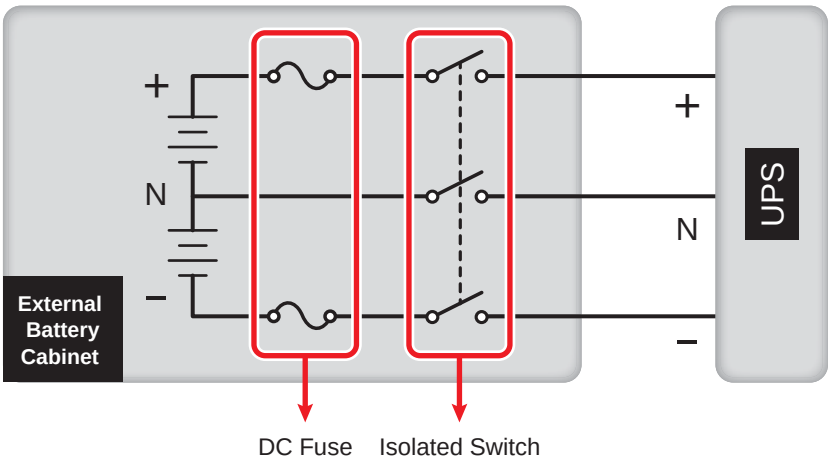
UPS Rating	60kVA	80kVA	100kVA	120kVA
DC Fuse (Voltage ≥ 500Vdc)	180 A	240 A	300 A	360 A
4-Pole DC Circuit Breaker (Per pole voltage ≥250Vdc)	150 A	200 A	250 A	300 A
3-Pole DC Circuit Breaker (Per pole voltage ≥500Vdc)	150 A	200 A	250 A	300 A
Battery Cable	16 mm² × 2 PCS	25 mm² × 2 PCS	50mm² × 2 PCS	50mm² × 2 PCS

NOTE:

1. The above-mentioned DC fuse and DC circuit breaker are optional. If you want to buy any of them, please contact Delta service personnel.
2. If you need to parallel multiple units of external battery cabinets, please contact Delta service personnel for relevant information.

- The external battery cabinet's protective device must be planned and designed by qualified service personnel. The protective device could be either an isolated switch connected in series with a DC fuse or a DC circuit breaker; please refer to ***Table 6-2***. When choosing the external battery cabinet's protective device, please take the following factors into consideration: (1) over current between the UPS and battery circuit, (2) short circuit, (3) wire/ cable material, and (4) local electrical regulations. If you have any questions about the external battery cabinet's protective device, please contact Delta service personnel. Please refer to ***Figure 6-18 ~ Figure 6-20*** for the installation of the external battery cabinet's protective device.

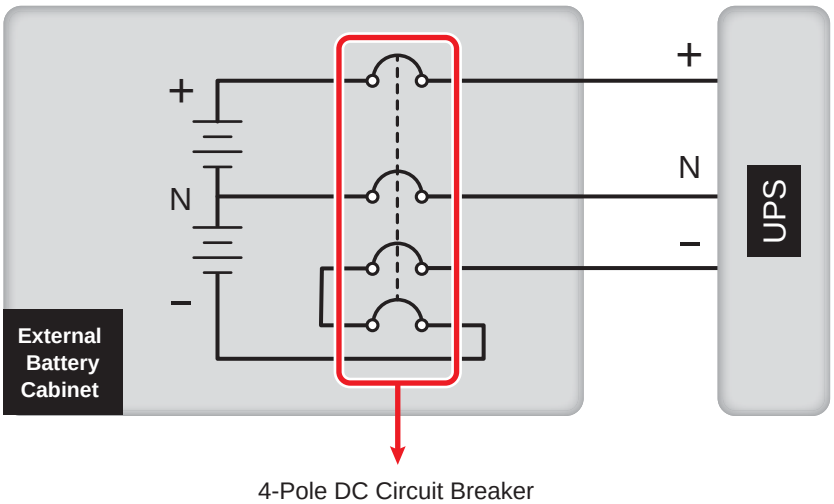
1. Option 1: An isolated switch connected in series with a DC fuse



(Figure 6-18: Installation of An Isolated Switch Connected in Series with a DC Fuse)

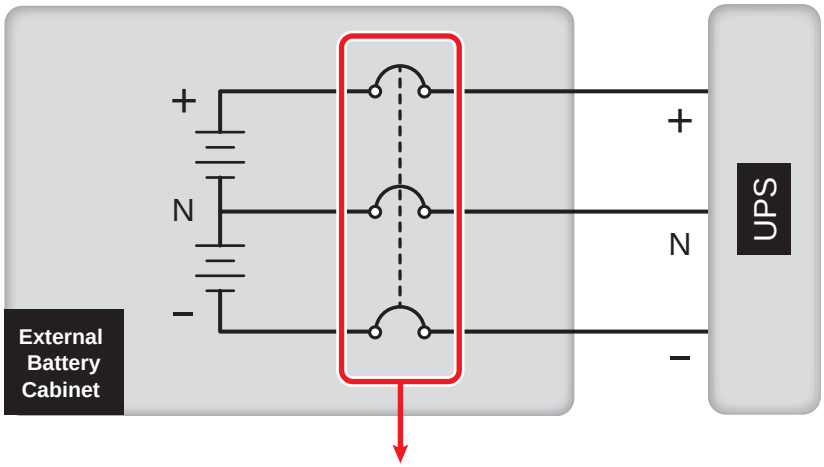
2. Option 2: A DC circuit breaker

1) 4-pole DC circuit breaker (per pole voltage ≥250Vdc)



(Figure 6-19: Installation of a 4-Pole DC Circuit Breaker)

2) 3-pole DC circuit breaker (per pole voltage ≥500Vdc)



(Figure 6-20: Installation of a 3-Pole DC Circuit Breaker)

- The parallel UPSs can connect with common batteries.

WARNING:

A battery can present a risk of electric shock and high short-circuit current. Servicing of batteries and battery cabinets must be performed or supervised by qualified service personnel knowledgeable in batteries, battery cabinets and the required precautions. Keep unauthorized personnel away from batteries and battery cabinets.

- **External Battery Cabinet Alarm**

When an external battery cabinet connected to the UPS has the following problems, the UPS system will sound an alarm. Please see the table below.

No.	External Battery Cabinet Status	Alarm
1	Battery Test Fail	Sounds once every 2 seconds.
2	Battery Low Warning	Sounds once every 0.5 second.
3	Battery Low Shutdown	Long beep (5 seconds)
4	Battery Over Charge	Sounds once every 2 seconds.
5	Battery Missing	Sounds once every 2 seconds.

Chapter 7 : UPS Operation

NOTE:

1. Before operation, please read this user manual thoroughly.
2. Before 1st start-up of the UPS, please make sure that each wiring is correct and the voltage difference between the Neutral (N) and the Ground (⏚) is <3V.
3. Do not turn on the manual bypass breaker when the UPS runs in online mode or battery mode.
4. Discharging the batteries once every three or six months for around 1/3 of backup time is suggested.
5. The **EPO** key (EPO) is for emergency use only. Do not randomly press the button.
6. Execution of the turn-off procedures will cut off all power supply. Before execution, please make sure that all connected critical loads have been safely shut down.

7.1 Single Unit Operation Procedures

7.1.1 Normal Mode Start-up Procedures (Single)

1. Before start-up, ensure that each breaker (including every external battery cabinet's breaker) is in the **OFF** position.
2. Turn on each external battery cabinet's breaker.
3. Turn on the output breaker.
4. For single input, please turn on the input breaker. For dual input, please turn on the input breaker and bypass breaker.
5. Wait for 60 seconds to let the DC BUS voltage finish establishment.
6. Press the **ON** key (ON) for 3~5 seconds and release it after you hear one beep.
7. After the **NORMAL LED** indicator (NORMAL) illuminates, it means that the normal mode start-up procedures are completed.

7.1.2 Battery Mode Start-up Procedures (Single)

1. Turn on each external battery cabinet's breaker.
2. Turn on the output breaker.
3. Press the **ON** key (ON) once to turn on the LCD display.
4. Press the **ON** key (ON) for 3~5 seconds and release it after you hear one beep.

5 After the **BATTERY LED** indicator (BATTERY) illuminates, it means that the battery mode start-up procedures are completed.

7.1.3 Bypass Mode Start-up Procedures (Single)

1 Before start-up, ensure that each breaker (including every external battery cabinet's breaker) is in the **OFF** position.

2 Turn on each external battery cabinet's breaker.

3 Turn on the output breaker.

4 For single input, please turn on the input breaker. For dual input, please turn on the input breaker and bypass breaker.

5 After the **BAPASS LED** indicator (BYPASS) illuminates, it means that the bypass mode start-up procedures are completed.

7.1.4 Manual Bypass Mode Start-up Procedures (Single Unit)

WARNING:

1. Please note that you can only turn on the Manual Bypass Breaker when the UPS needs maintenance. This ensures that the supply of power to the critical loads will continue. If you turn on the Manual Bypass Breaker during normal mode, the inverter will shut down, the UPS will transfer from normal mode to manual bypass mode, and the output won't be protected.
2. In manual bypass mode, the manual bypass supplies power to the critical loads and maintenance personnel can perform maintenance without interrupting the power supply to the critical loads.
3. When the UPS is in manual bypass mode, there is no high voltage inside the UPS except the wiring terminal block and the Manual Bypass Breaker. Do not touch the wiring terminal block and the Manual Bypass Breaker to avoid electrical shock.

- **From Normal Mode to Manual Bypass Mode (Single)**

1 Press the **OFF** key (OFF) once and press the **DOWN** key (▼) to confirm that you want to shut down the UPS. After that, the **BYPASS LED** indicator (BYPASS) will illuminate.

2 Turn on the manual bypass breaker.

3 For single input, please turn off the input breaker. For dual input, please turn off the input breaker and bypass breaker.

4 Turn off the output breaker.

5 Ensure that the DC BUS voltage drops to below 20V.

6 Confirm that the discharging process is completed and the UPS is shut down.

7 Turn off each external battery cabinet's breaker.

- **From Manual Bypass Mode to Normal Mode (Single)**

1 Turn on every external battery cabinet's breaker.

2 Turn on the output breaker.

3 For single input, please turn on the input breaker. For dual input, please turn on the input breaker and bypass breaker.

4 Confirm that the UPS runs in bypass mode and the **BYPASS LED** indicator (BYPASS) illuminates.

5 Turn off the manual bypass breaker.

6 Press the **ON** key (ON) for 3~5 seconds and release it after you hear one beep.

7 After the **NORMAL LED** indicator (NORMAL) illuminates, it means that the start-up procedures from manual bypass mode to normal mode are completed.

7.1.5 Normal Mode Turn-off Procedures (Single)

Execution of the following procedures will cut off all power supply. Before execution, please make sure that all connected critical loads have been safely shut down.

1 Press the **OFF** key (OFF) once and press the **DOWN** key (▼) to confirm that you want to shut down the UPS.

2 For single input, please turn off the input breaker. For dual input, please turn off the input breaker and bypass breaker.

3 Turn off the output breaker.

4 Ensure that the DC BUS voltage drops to below 20V.

5 Wait until the LCD display is off and ensure that the discharging process is completed and the UPS is shut down.

6 Turn off each external battery cabinet's breaker.

7.1.6 Battery Mode Turn-off Procedures (Single)

Execution of the following procedures will cut off all power supply. Before execution, please make sure that all connected critical loads have been safely shut down.

1 Press the **OFF** key (OFF) once and press the **DOWN** key (▼) to confirm that you want to shut down the UPS.

2 For single input, please turn off the input breaker. For dual input, please turn off the input breaker and bypass breaker.

3 Turn off the output breaker.

4 Ensure that the DC BUS voltage drops to below 20V.

5 Wait until the LCD display is off and ensure that the discharging process is completed and the UPS is shut down.

6 Turn off each external battery cabinet's breaker.

7.1.7 Bypass Mode Turn-off Procedures (Single)

Execution of the following procedures will cut off all power supply. Before execution, please make sure that all connected critical loads have been safely shut down.

1 For single input, please turn off the input breaker. For dual input, please turn off the input breaker and bypass breaker.

2 Turn off the output breaker.

3 Ensure that the DC BUS voltage drops to below 20V.

4 Wait until the LCD display is off and ensure that the discharging process is completed and the UPS is shut down.

5 Turn off each external battery cabinet's breaker.

7.1.8 Manual Bypass Mode Turn-off Procedures (Single)

Execution of the following procedures will cut off all power supply. Before execution, please make sure that all connected critical loads have been safely shut down.

1 For single input, please turn off the input breaker. For dual input, please turn off the input breaker and bypass breaker.

2 Turn off the output breaker.

3 Ensure that the DC BUS voltage drops to below 20V.

4 Wait until the LCD display is off and ensure that the discharging process is completed and the UPS is shut down.

5 Turn off each external battery cabinet's breaker.

6 Turn off the manual bypass breaker.

7.2 Parallel Units Operation Procedures

7.2.1 Normal Mode Start-up Procedures (Parallel)

1. Before start-up, ensure that each breaker (including every external battery cabinet's breaker) is in the **OFF** position.
2. Turn on each UPS's external battery cabinet's breaker.
3. Turn on each UPS's output breaker.
4. For single input, please turn on each UPS's input breaker. For dual input, please turn on each UPS's input breaker and bypass breaker.
5. Make sure that each UPS runs in bypass mode and each UPS's **BYPASS LED** indicator (BYPASS) illuminates.
6. Wait for 60 seconds to let the DC BUS voltage finish establishment.
7. Ensure that each UPS's communication function is normal. After that, press each UPS's **ON** key (ON) for 3~5 seconds and release it after you hear one beep to start up each UPS.
8. Now, each UPS's **NORMAL LED** indicator (NORMAL) illuminates.

7.2.2 Battery Mode Start-up Procedures (Parallel)

1. Turn on each UPS's external battery cabinet's breaker.
2. Turn on each UPS's output breaker.
3. Press each UPS's **ON** key (ON) once to turn on the LCD display.
4. Press each UPS's **ON** key (ON) for 3~5 seconds and release it after you hear one beep.
5. After each UPS's **BATTERY LED** indicator (BATTERY) illuminates, it means that the battery mode start-up procedures are completed.

7.2.3 Bypass Mode Start-up Procedures (Parallel)

1. Before start-up, ensure that each breaker (including every external battery cabinet's breaker) is in the **OFF** position.
2. Turn on each UPS's external battery cabinet's breaker.
3. Turn on each UPS's output breaker.

4 For single input, please turn on each UPS's input breaker. For dual input, please turn on each UPS's input breaker and bypass breaker.

5 Ensure that each UPS runs in bypass mode and each UPS's **BYPASS LED** indicator (BYPASS) illuminates.

7.2.4 Manual Bypass Mode Start-up Procedures (Parallel)

WARNING:

1. Please note that you can only turn on the Manual Bypass Breaker when the UPS needs maintenance. This ensures that the supply of power to the critical loads will continue. If you turn on the Manual Bypass Breaker during normal mode, the inverter will shut down, the UPS will transfer from normal mode to manual bypass mode, and the output won't be protected.
2. In manual bypass mode, the manual bypass supplies power to the critical loads and maintenance personnel can perform maintenance without interrupting the power supply to the critical loads.
3. When the UPS is in manual bypass mode, there is no high voltage inside the UPS except the wiring terminal block and the Manual Bypass Breaker. Do not touch the wiring terminal block and the Manual Bypass Breaker to avoid electrical shock.

- **From Normal Mode to Manual Bypass Mode (Parallel)**

1 Press the **OFF** key (OFF) of the UPS that you want to shut down once and press the **DOWN** key (▼) to confirm that you want to shut down the UPS.

2 Repeat the procedures stated in 1 to let each parallel UPS transfer to run in bypass mode. At this moment, each UPS's **BYPASS LED** indicator (BYPASS) illuminates.

3 Turn on each UPS's manual bypass breaker.

4 For single input, please turn off each UPS's input breaker. For dual input, please turn off each UPS's input breaker and bypass breaker.

5 Turn off each UPS's output breaker.

6 Ensure that each UPS's DC BUS voltage drops to below 20V.

7 Confirm that each UPS's discharging process is completed and each UPS is shut down.

8 Turn off each UPS's external battery cabinet's breaker.

- **From Manual Bypass Mode to Normal Mode (Parallel)**

  1 Turn on each UPS's external battery cabinet's breaker.

  2 Turn on each UPS's output breaker.

  3 For single input, please turn on each UPS's input breaker. For dual input, please turn on each UPS's input breaker and bypass breaker.

  4 Confirm that each UPS runs in bypass mode and the **BYPASS LED** indicator (BYPASS) illuminates.

  5 Turn off each UPS's manual bypass breaker.

  6 Press each UPS's **ON** key(ON) for 3~5 seconds and release it after you hear one beep.

  7 After each UPS's **NORMAL LED** indicator(NORMAL) illuminates, it means that the start-up procedures from manual bypass mode to normal mode are completed.

7.2.5 Normal Mode Turn-off Procedures (Parallel)

If you want to shut down one of the parallel UPSs, please follow the procedures below.

1 Press the **OFF** key(OFF) of the UPS that you want to shut down once and press the **DOWN** key(▼) to confirm that you want to shut down the UPS.

2 For single input, please turn off the UPS's input breaker. For dual input, please turn off the UPS's input breaker and bypass breaker.

3 Turn off the UPS's output breaker.

4 Ensure that the UPS's DC BUS voltage drops to below 20V.

5 After the UPS that you want to shut down completes the discarding process, the UPS's LCD display will be off.

6 Turn off the UPS's external battery cabinet's breaker.

7.2.6 Battery Mode Turn-off Procedures (Parallel)

If you want to shut down one of the parallel UPSs, please follow the procedures below.

1 Press the **OFF** key(OFF) of the UPS that you want to shut down once and press the **DOWN** key(▼) to confirm that you want to shut down the UPS.

2 For single input, please turn off the UPS's input breaker. For dual input, please turn off the UPS's input breaker and bypass breaker.

3 Turn off the UPS's output breaker.

4 Ensure that the UPS's DC BUS voltage drops to below 20V.

5 After the UPS that you want to shut down completes the discarding process, the UPS's LCD display will be off.

6 Turn off the UPS's external battery cabinet's breaker.

7.2.7 Bypass Mode Turn-off Procedures (Parallel)

If you want to shut down one of the parallel UPSs, please follow the procedures below.

1 For single input, please turn off the input breaker of the UPS that you want to shut down. For dual input, please turn off the input breaker and bypass breaker of the UPS that you want to shut down.

2 Turn off the UPS's output breaker.

3 Ensure that the UPS's DC BUS voltage drops to below 20V.

4 After the UPS that you want to shut down completes the discarding process, the UPS's LCD display will be off.

5 Turn off the UPS's external battery cabinet's breaker.

7.2.8 Manual Bypass Mode Turn-off Procedures (Parallel)

If you want to shut down one of the parallel UPSs, please follow the procedures below.

1 For single input, please turn off the input breaker of the UPS that you want to shut down. For dual input, please turn off the input breaker and bypass breaker of the UPS that you want to shut down.

2 Turn off the UPS's output breaker.

3 Ensure that the UPS's DC BUS voltage drops to below 20V.

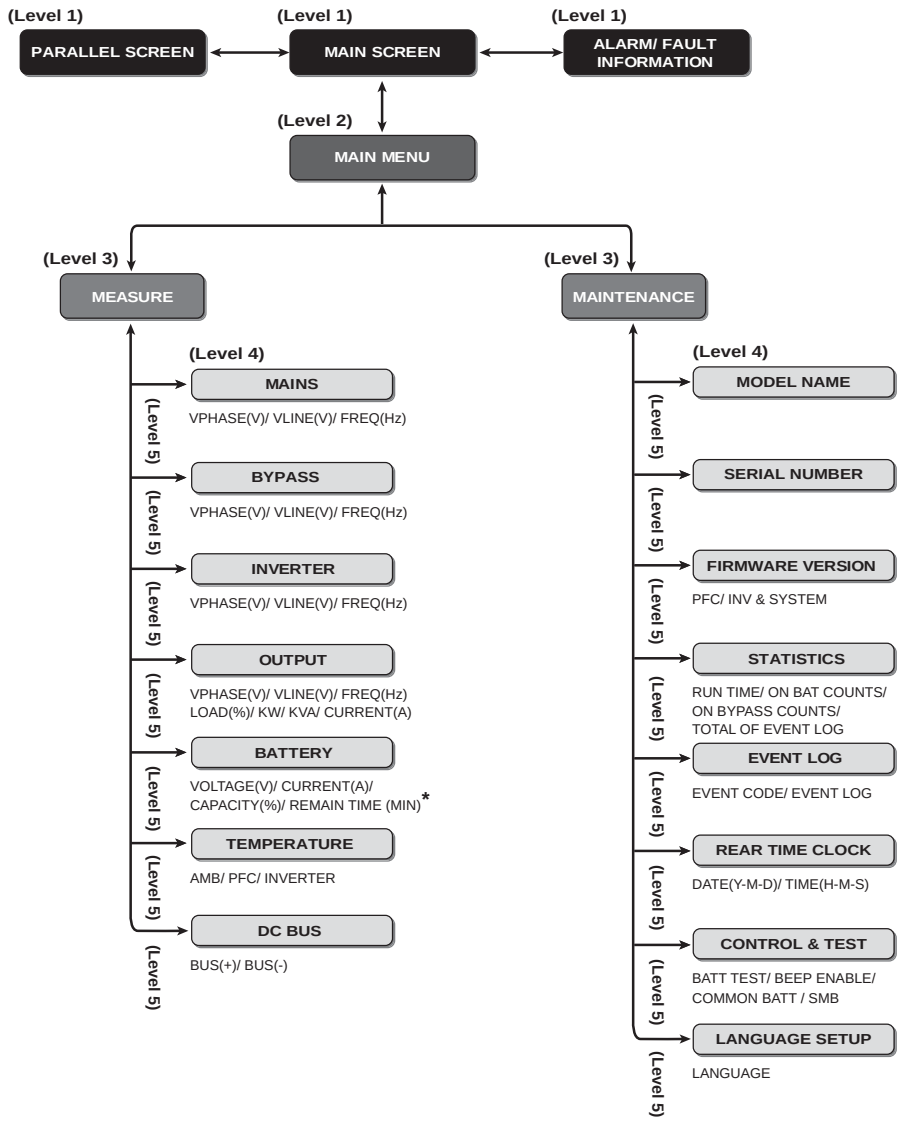
4 After the UPS that you want to shut down completes the discarding process, the UPS's LCD display will be off.

5 Turn off the UPS's external battery cabinet's breaker.

6 Turn off the UPS's manual bypass breaker.

Chapter 8 : LCD Display and Settings

8.1 LCD Display Hierarchy



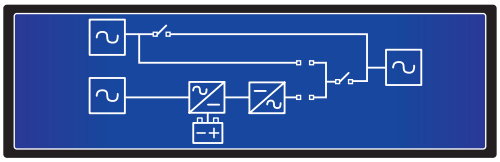
(Figure 8-1: LCD Display Hierarchy)

NOTE:

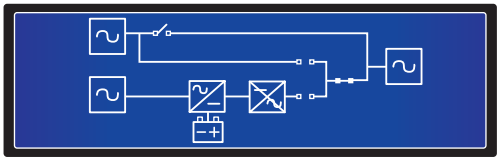
1. Please refer to ***3.2 Control Panel*** for information about the LCD and function keys.
2. All information shown in the LCD diagrams presented in ***Chapter 8 : LCD Display and Settings*** are for reference only. Actual readings depend on the operation of the UPS.
3. * Means that only service personnel can enable this function.

8.2 Main Screen

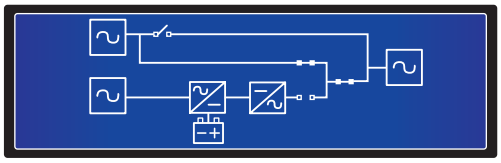
After initialization, the LCD will show current UPS status diagram as follows. The system shows different screens depending on the status of the UPS. There are six statuses, and each is called **Main Screen**. Please see below for further information.



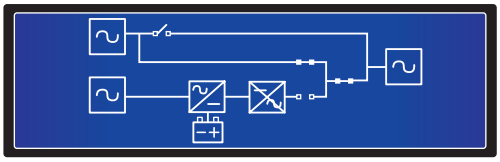
The six statuses of the UPS shown in the LCD display are as follows.

❶ 

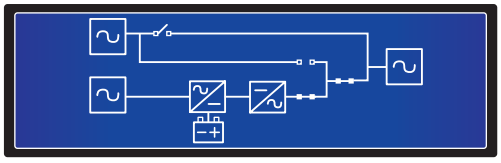
When the screen above appears, it means that no power is supplied to the critical loads connected.

❷ 

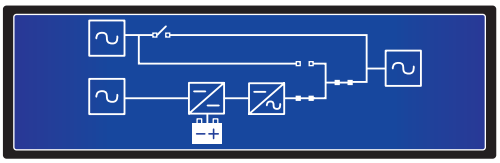
When the screen above appears, it means the bypass is supplying power to the critical loads.

❸ 

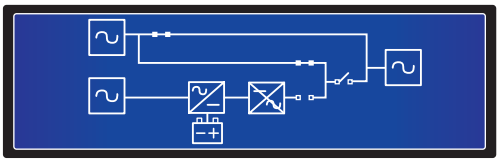
When the screen above appears, it means that the UPS is in bypass mode and the inverter is off. If the bypass AC source fails, the critical loads won't be protected.

❹ 

When the screen above appears, it means that the UPS is in normal mode.

❺ 

When the screen above appears, it means that the UPS is in battery mode.

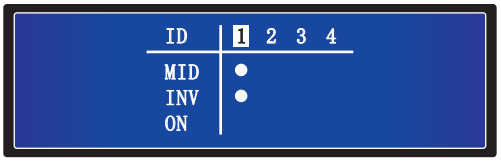
❻ 

When the screen above appears, it means that the UPS is in manual bypass mode. Before maintenance, do not forget to switch the UPS into manual bypass mode, cut off the main AC source and battery power, and turn off the output breaker. During this mode, if the bypass AC source fails, the critical loads won't be protected.

WARNING: If the output breaker is not turned off during maintenance, there is a risk of electric shock.

8.3 Parallel Screen

When UPSs are paralleled, press either the function key (▲) or (▼) in a Main Screen to enter into the Parallel Screen as follows.



- **ID:** In parallel mode, this means the UPS's ID No.
- **MID:** Master UPS's ID No. (In parallel mode, there is only one mater UPS).
- **INV:** "●" means 'CONNECTED'
- **ON:** "●" means 'INVERTER ON'

8.4 Main Menu

In a Main Screen, press the function key (↵) to enter into the Main Menu shown below.

- **MEASURE**

  Check the UPS's mains, bypass, inverter, output, battery, temperature and DC BUS readings.

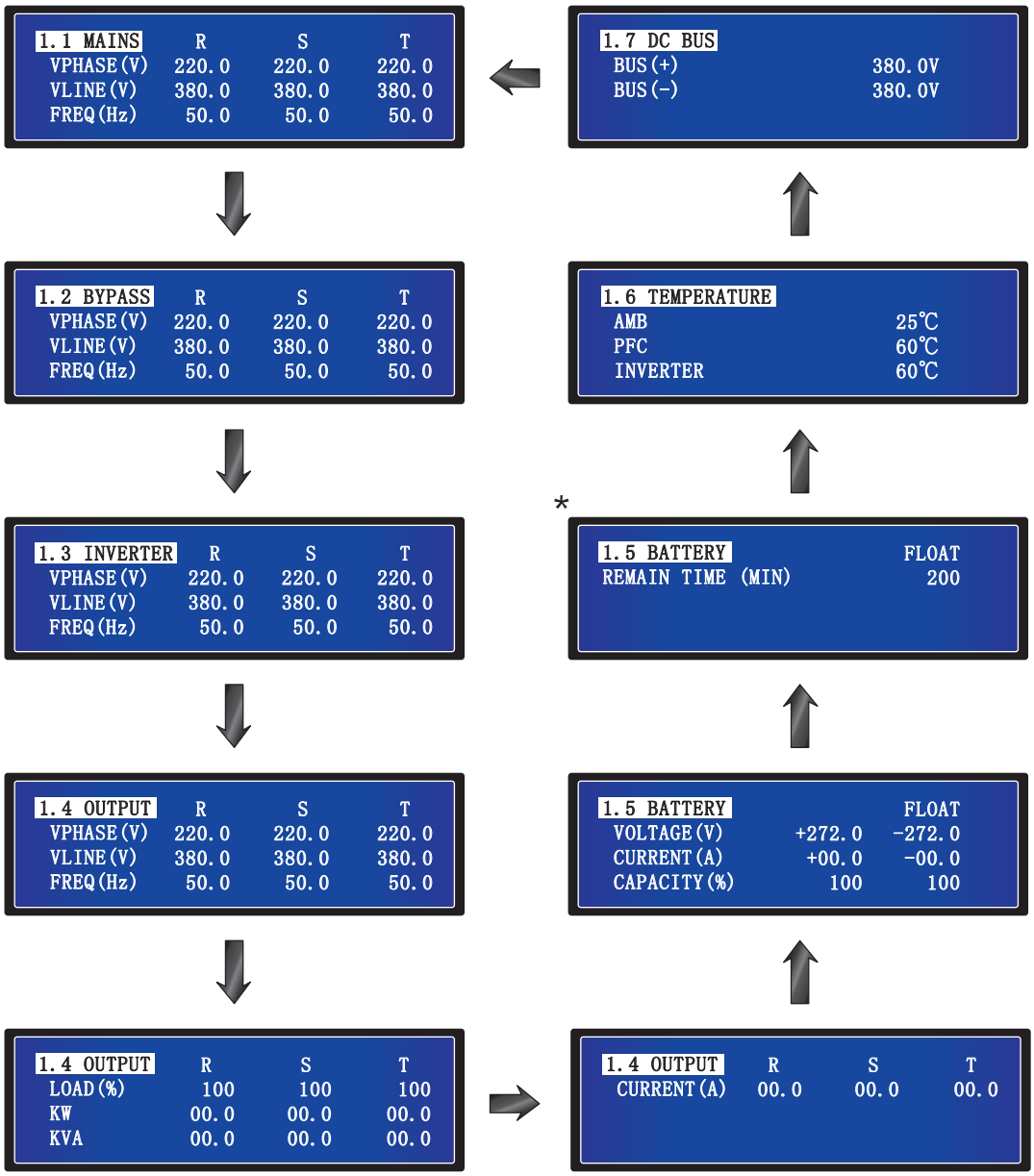
- **MAINTENANCE**

  Check the UPS's model name, serial number, firmware version, statistics, event log, real time clock, control & test, and language setup. User can set up the last two items.

8.5 Measure

Route: Main Screen → Main Menu → Measure

Use the function keys (▲) and (▼) to check the UPS's mains, bypass, inverter, output, battery, temperature and DC BUS readings. Please refer to the charts below.



NOTE: * Means that only service personnel can enable this function.

8.6 Maintenance

Route: Main Screen → Main Menu → Maintenance

Use the function keys (▲) and (▼) to check the UPS's model name, serial number, firmware ver-sion, statistics, event log, real time clock, control & test, and language setup. User can set up the last two items. Please see below for detailed information.

- **Model Name**

  Route: Main Screen → Main Menu → Maintenance → 2.1 Model Name

  The screen above shows the UPS's model name.

- **Serial Number**

  Route: Main Screen → Main Menu → Maintenance → 2.2 Serial Number

  The screen above shows the UPS's serial number.

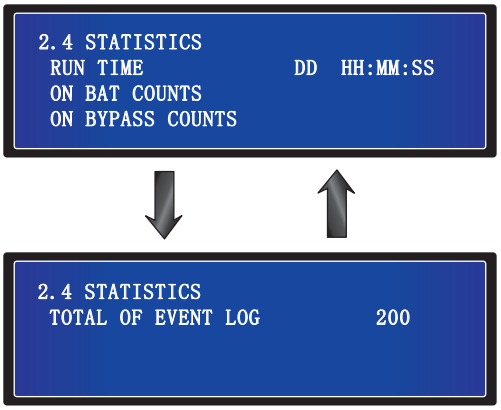
- **Firmware Version**

  Route: Main Screen → Main Menu → Maintenance → 2.3 Firmware Version

  The screen above shows the PFC and the INV & SYSTEM's firmware version.

- **Statistics**

  Route: Main Screen → Main Menu → Maintenance → 2.4 Statistics



1. **RUN TIME (DD HH: MM: SS):** The UPS's total running time.
2. **ON BAT COUNTS:** How many times the UPS runs in battery mode.
3. **ON BYPASS COUNTS:** How many times the UPS runs in bypass mode.
4. **TOTAL OF EVENT LOG:** The UPS's total number of event log.

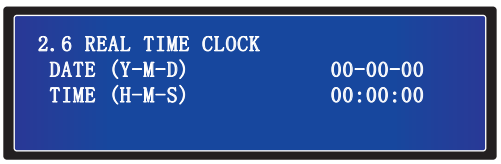
- **Event Log**

  Route: Main Screen → Main Menu → Maintenance → 2.5 Event Log

  The screen above shows event No., event date, time, and event descriptions. Use the function keys (▲) and (▼) to view other events. The event number means the event code. The greater the event number, the newer the event. Old events will be overwritten when the total number of events exceeds storage capacity (up to 200 entries can be saved).

- **Real Time Clock**

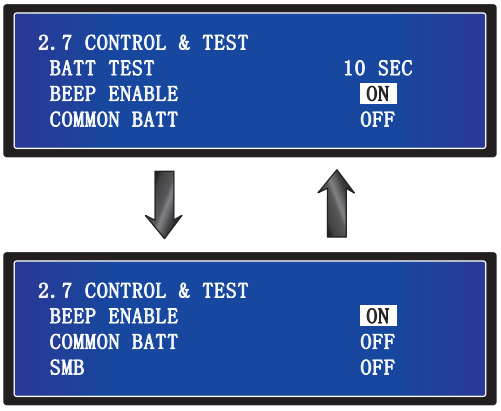
  Route: Main Screen → Main Menu → Maintenance → 2.6 Real Time Clock



  The screen above shows date and time.

- **Control & Test**

  Route: Main Screen → Main Menu → Maintenance → 2.7 Control & Test



1. **BATT TEST:** Enable or disable battery test. Three are three choices, **ABORT**, **DEEP** or **10 SEC**.
2. **BEEP ENABLE:** Enable or disable buzzer.
3. **COMMON BATT:** Enable or disable the function of common battery.
4. **SMB:** Enable or disable the SMB function.

- **Language Setup**

  Route: Main Screen → Main Menu → Maintenance → 2.8 Language Setup

You can change the display language. The default setting is **ENGLISH**.

Chapter 9 : Optional Accessories

There are several optional accessories available for this HPH series UPS. Please refer to the table below for the optional accessories and their descriptions.

No.	Item	Function
1	Dust Filter	Prevents dust from entering into the UPS to ensure UPS reliability and to prolong product life.
2	EnviroProbe	Monitors temperature, humidity and other conditions in a room environment. The EnvioProbe should work with either an SNMP card or an EMS2000.
3	SNMP Card (IPv4 or IPv6)	Monitors and controls the status of the UPS via a network system.
4	Relay I/O Card	Increases the quantity of dry contacts.
5	ModBus Card	Lets the UPS have ModBus communication function.
6	Mini TVSS Card	Lets the UPS have surge protection function.
7	Mini USB Card	Lets the UPS have USB communication function.
8	Mini SNMP Card	Monitors and controls the status of the UPS via a network system.
9	Mini Relay I/O Card	Increases the quantity of dry contacts.
10	Mini ModBus Card	Lets the UPS have ModBus communication function.
11	Battery Cabinet Temperature Sensor Cable	Detects an external battery cabinet's temperature.
12	Cable Entry Cabinet	Provides top cable entry application.
13	Waterproof Cover	Meets IPX1 waterproof requirement.
14	Charger Board-20A	Provides additional charge current. Please see below for each kVA's application: 1. 60 kVA: Replace its interior 10A charger board with the 20A charger board. 2. 100/ 120 kVA:Additionally install the 20A charger board to increase the charge current to reach at maximum 40A.

REFERENCE:

1. For detailed installation and operation of any accessory mentioned above, please refer to the ***Quick Guide, User Guide, or Installation & Operation Guide*** included in the package of the relevant optional accessory.
2. If you want to buy any accessory mentioned above, please contact your local dealer or customer service.

Chapter 10 : Maintenance

- **UPS**

  1. UPS Cleaning:

     Regularly clean the UPS, especially the slits and openings, to ensure that the air freely flows into the UPS to avoid overheating. If necessary, use an air-gun to clean the slits and openings to prevent any object from blocking or covering these areas.

  2. UPS Regular Inspection:

     Regularly check the UPS every half year and inspect:

     1) Whether the UPS, LEDs, and alarm function are operating normally.

     2) Whether the UPS works in bypass mode (normally, the UPS will work in normal mode). If yes, check if any error, overload, internal fault, etc. occurs.

     3) Whether battery voltage is normal. If the battery voltage is too high or too low, find the root cause.

- **Battery**

  The HPH series UPS uses sealed lead-acid batteries. The battery life depends on the temperature, the usage, and the charging/ discharging frequency. High temperature environments and high charging/ discharging frequency will quickly shorten the battery life. Please follow the suggestions below to ensure a normal battery lifetime.

  1. Keep usage temperature between 15°C~25°C.
  2. When the UPS needs to be stored for an extended period of time, the batteries must be recharged once every three months and the charging time must not be less than 24 hours each time.

- **Fan**

  Higher temperatures shorten fan life. When the UPS is running, please check if all fans work normally and make sure if the ventilation air can move freely around and through the UPS. If not, replace the fans.

NOTE:

Please ask your local dealer or customer service for more maintenance information. Do not perform maintenance if you are not trained for it.

Chapter 11 : Troubleshooting

No.	Alarm Message	Possible Cause	Solution
1	SHORT CIRCUIT	Output has a short circuit issue.	Contact service personnel.
2	INVERTER FAIL	Inverter is damaged.	Contact service personnel.
3	OVER TEMPERATURE	The UPS temperature is too high.	1. Choose a well-ventilated area. 2. Decrease some loads. 3. Check if fans run normally. 4. Clean filters if installed.
4	PFC AMBIENT OVER TEMP. FAIL	The UPS temperature is too high.	1. Choose a well-ventilated area. 2. Decrease some loads. 3. Check if fans run normally. 4. Clean filters if installed.
5	INVERTER SCR OPEN	Inverter SCR driver is abnormal.	Contact service personnel.
6	BYPASS SCR OPEN	Bypass SCR driver is abnormal.	Contact service personnel.
7	OVERLOAD	The UPS is overloaded.	Remove some unnecessary loads to let total load capacity below 95%.
8	FAN FAIL	Fans are damaged or stuck.	Contact service personnel.
9	BYPASS SCR SHORT FAIL	1. Bypass SCR driver is damaged. 2. Bypass SCR has a short circuit issue.	Contact service personnel.
10	INPUT SCR SHORT FAIL	1. Input SCR driver is damaged. 2. Input SCR has a short circuit issue.	Contact service personnel.
11	OUTPUT FUSE FAIL	Output fuse is broken.	Contact service personnel.
12	AUX POWER FAIL	Auxiliary power is damaged.	Contact service personnel.
13	INDUSTRY PROTECT	In industrial mode, output has an over current issue.	Check if output is normal.
14	BATTERY REVERSED	Batteries are connected in reverse.	Please check the batteries' polarity.

No.	Alarm Message	Possible Cause	Solution
15	INPUT PHASE SEQUENCE FAIL	Input phase sequence is wrong.	Check input phase sequence.
16	INVERTER SOFT START FAIL	1. Inverter detection is abnormal. 2. Inverter's driver is damaged.	Contact service personnel.
17	INNER COMMUNICATION FAIL	Inner communication cable is not well connected.	Contact service personnel.
18	PFC SUPERVISOR FAIL	PFC CPU is damaged.	Contact service personnel.
19	DC BUS HIGH SHUTDOWN	1. Output has abnormalities. 2. The UPS has internal faults.	Contact service personnel.
20	DC BUS LOW SHUTDOWN	1. Output has abnormalities. 2. The UPS has internal faults.	Contact service personnel.
21	INPUT FUSE FAIL	Input fuse is broken.	Contact service personnel.
22	INVERTER SUPERVISOR FAIL	Inverter CPU is damaged.	Contact service personnel.
23	PFC SOFT START FAIL	1. Rectifier tube is damaged. 2. Driver is damaged.	Contact service personnel.
24	BYPASS PHASE SEQUENCE FAIL	Bypass phase sequence is wrong.	Please check bypass phase sequence.
25	NTC OPEN FAIL	1. NTC is not connected well. 2. NTC line is broken.	Contact service personnel.
26	INVERTER OUTPUT SCR SHORT	1. Inverter SCR driver is abnormal. 2. Inverter SCR is damaged.	Contact service personnel.
27	BATTERY LOW SHUTDOWN	Battery voltage is low.	Charge the batteries.

NOTE:

If all possible causes are eliminated but the alarm still appears, please contact your local dealer or customer service.

Appendix 1 : Technical Specifications

Model		HPH-60K	HPH-80K	HPH-100K	HPH-120K
Power Rating		60kVA/60KW	80kVA/80KW	100kVA/100KW	120kVA/120KW
Input	Nominal Voltage	220/380 Vac; 230/400 Vac; 240/415 Vac			
	Voltage Range	300~477 Vac (full load)			
	Frequency	50/60 Hz			
	Frequency Range	40~70 Hz			
	Current Harmonic Distortion	< 3%*1			
	Power Factor	> 0.99 (full load)			
Output	Nominal Voltage	220/380 Vac; 230/400 Vac; 240/415 Vac			
	Power Factor	1*2			
	Voltage Regulation	± 1%			
	Voltage Harmonic Distortion	< 2% (linear load)			
	Overload Capability	≤ 105%: continuous; 106% ~ ≤ 125%: 10 minutes; 126% ~ ≤ 150%: 1 minute; > 150%: 1 second			
	Output Frequency	50/60 Hz ± 0.05 Hz			
	Cress Factor	3:1			
Efficiency	Online Mode	up to 96%			
	ECO Mode	up to 99%			
Battery	Type	SMF/ VRLA			
	Voltage	±240 Vdc (default)			
	Standard Charger Current	10A	15A	20A	20A
	Charge Voltage	Float charge: 272±2 Vdc; Boost charge: 280±2 Vdc			
Audible Noise		< 65 dBA			
LED & LCD		LED indicators and Multi-language LCD display			

Model		HPH-60K	HPH-80K	HPH-100K	HPH-120K
Communication Interfaces		SMART Slot × 1, MINI Slot × 1, Parallel Port × 2, RS-232 Port × 1, USB Port × 1, REPO Port × 1, Charger Detection Port × 1, Input Dry Contact × 2, Output Dry Contact × 6, Battery cabinet temperature sensor port × 2			
Manual Bypass Breaker		Yes			
Physical	Dimensions (W x D x H)	520×800×1175 mm		520×800×1760 mm	
	Weight	186.5 kg	192.5 kg	312 kg	
Environment	Operating Temperature	0 ~ 40℃			
	Ambient Storage Temperature	-20 ~ 50℃			
	Relative Humidity	5% ~ 95% (non-condensing)			

NOTE:

1. Refer to the rating label for the safety rating.
2. All specifications are subject to change without prior notice.

*1 : When input vTHD is <1%.

*2 : When input voltage is between 340~477Vac and the number of batteries is the same as default value.

Appendix 2 : Warranty

Seller warrants this product, if used in accordance with all applicable instructions, to be free from original defects in material and workmanship within the warranty period. If the product has any failure problem within the warranty period, Seller will repair or replace the product at its sole discretion according to the failure situation.

This warranty does not apply to normal wear or to damage resulting from improper installation, operation, usage, maintenance or irresistible force (i.e. war, fire, natural disaster, etc.), and this warranty also expressly excludes all incidental and consequential damages.

Maintenance service for a fee is provided for any damage out of the warranty period. If any maintenance is required, please directly contact the supplier or Seller.

WARNING!

The individual user should take care to determine prior to use whether the environment and the load characteristic are suitable, adequate or safe for the installation and the usage of this product. The User Manual must be carefully followed. Seller makes no representation or warranty as to the suitability or fitness of this product for any specific application.

Smarter. Greener. Together.

5013226400